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Contents

Overcoming Constraints

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Introduction

The dairy industry is one of the most important sectors of Irish Agriculture and accounts for 31 % of Agricultural Output (DAFF, 2003) with the production of 5.35 million tonnes of milk per annum. The processing industry has become one of the country's most important indigenous industries with a turnover of over €2.5 billion in 2001 employing over 9,000 people in related activities, and with 25,500 dairy farmers supplying raw material. The dairy industry also has made a significant contribution to sustaining rural communities over the last decade. Since joining the European Community in 1973, Irish milk producers have enjoyed relatively high milk prices due to the support system of the Common Agricultural Policy (CAP). However, dairy farmers are now facing important changes to their economic environment. In particular, the Luxembourg agreement on the reform of the CAP (Mid Term Review) entails a fundamental change in agricultural policy with the decoupling of support measures from production. In Ireland, full decoupling will be introduced from 2005 and milk price is projected to fall by up to 5.0 cent per litre (c/l) due to reduced price support for butter and skimmed milk powder. These changes mean that many dairy farmers need to reappraise their business strategy and consider necessary adjustments that will ensure viability in the longer term. The objectives of this paper are to examine the effect of four key constraints to expansion in dairy farms i.e. availability and cost of labour, capital costs, milk quota availability and price and land availability for the grazing dairy herd. Particular emphasis in this analysis will be on defining a system of milk production that will maximise profit in an expanding environment. Of the four constraints listed land availability will be dealt with in most detail in this paper.

(1) Labour

The cost, availability and skill level of farm labour is now becoming a critical issue for dairy farmers. Young people need the opportunity to enter farming. New strategies are required to deal with this issue. Farm partnerships offer good opportunities. Access of young people into farming needs to be facilitated. The Moorepark Farm Labour study showed an average daily labour input of 10.1 hours/day in which milking accounted for 30% of the time. Labour efficiency on dairy farms will have to increase significantly in the future if average quota size increases. The Moorepark farm labour study found that the efficiency of labour input increased significantly with increased herd size. In the small quota category 136,-250,000litres (30-55,000 gallons) an average of 7.9 hours were spent working per day. In the largest quota size category 500,-1,455,000litres (110-320,000gallons), an average of 14.1 hours were spent working per day which clearly shows the higher quota size category were more labour efficient.

(2) Capital Costs

The Fischler Reforms have made the exit from dairy farming more attractive than before as the decoupled premium can be retained even if milk is not produced. Significant restructuring is expected within the sector. The FAPRI-Ireland group predicts that dairy farm numbers will fall to 18,000 by 2010, with average milk quota size increasing from 181,840 litres (40,000 gallons) to 295,500 litres (65,000 gallons) (Breen and Hennessey, 2003).

To accommodate expansion extra housing and milking facilities will be required on many dairy farms. This investment will have to be made at a time when milk price could fall by approximately 4.5-5.0c/l by 2012 as commodity support prices are reduced. While existing cattle accommodation will be converted on many mixed dairy farms, specialist dairy farms and those with a small dry-stock enterprise will need to construct new dairy cow accommodation to facilitate the increase in cow numbers. The capital cost of conventional housing systems for a

100 cow herd is estimated at €160,000 compared to €17,800 for an out wintering pad plus an earth bank tank to contain all slurry plus soiled water. When both systems are financed with a 15-year term loan with interest rate fixed at 7.3% the difference in annual costs (interest plus depreciation costs) is 1.6 c/l. In a recent study carried out by Shalloo et al., (2004) it was shown that dairy farmers can maintain their real incomes over the next 10 years by expanding their enterprise using low-cost facilities. A major advantage of low capital cost wintering systems is that it allows farmers with limited resources to put facilities in place and thereby gain control over the consolidation or expansion of their business.

(3) Milk Quota

Currently, milk quota transfer in Ireland takes place through an administrated system with a fixed price and reallocation based on a priority system that favours smaller milk producers. Therefore, the true market value of milk quota is unknown in Ireland. The Minister for Agriculture sets the price of milk quota with advice from the Milk Quota Review Group. Traditionally the quantity of milk quota available for restructuring in Ireland has varied substantially between regions. FAPRI-Ireland farm level research suggests that post-decoupling (2005) a larger amount of milk quota will be available for restructuring due to the decoupling of the dairy premium. If the number of specialist dairy farmers declines from 26,000 to 18,000 as projected and the average size of the exiting farmer is 200,000 litres (44,000 gallons) then the remaining farmers can increase quota size by 88,650 litres (19,500 gallons) or 45%.

In a market-based system, the price that a producer should pay for milk quota should be related to the additional farm profit he/she expects to earn in the future from the extra milk quota purchased. In a recent study carried out by Shalloo et al., (2004) the breakeven price that dairy farmers could afford to pay for milk quota was calculated for high, average and low cost producers, based on data from the National Farm Survey (NFS), for different stages of expansion. It was shown that when dairy farmers replaced the beef enterprise on the farm and increased milk yield per cow the breakeven price the low, average and high cost producers could afford to pay for milk quota in 2005 was 51.0, 5.0 and –12.0 c/l respectively. In a second stage of expansion where the beef enterprise was replaced, milk yield was increased per cow and there was further expansion buying cows and building conventional type housing the breakeven price that low, average and high cost producers could pay for milk quota in 2005 was 14.0, -14.0 and –41.0 c/l respectively. It was concluded from this study that the price at which quota becomes available to farmers needs to decline in 2005 and decline each year subsequently.

(4) Land

Grazed grass is the cheapest feed available to Irish dairy farmers (O' Kiely, 1994). Therefore, the milk production system on Irish dairy farms should be largely based on the maximization of this cheap feed i.e. grazed grass. Significant variations exist in grass growth and trafficability of land between different regions in the country. Grass growth in the south of the country extends for over 300 days while in the north of the country grass growth occurs for only 270 days. Studies carried out at Moorepark and Ballyhaise have shown that there is little difference in the total herbage supply between the two sites but there are temporal differences in herbage growth throughout the year. At the Moorepark site approximately 23% of the total yearly grass production is obtained from January 1 to May 1 while at the corresponding value at the Ballyhaise site is 18%. Similarly from September 1 to December 31, 18% of the total grass production occurs at Moorepark, while the corresponding value at Ballyhaise is 14%. The other main difference between the north and the south is the feasibility of grazing. The south generally has more free draining type soils than the north, allowing earlier grazing in the Spring and later grazing in the Autumn. However, regardless of location, the overall objective of the dairy system employed should be to maximise the amount of grass in the diet of the dairy herd.

The objective of this section of the paper is to determine the optimum system of milk production for two sites Moorepark and Ballyhaise by comparing three grass based feeding systems i.e. High Grass, High Concentrate and High Maize Silage.

Methodology used to compare the systems

Data from a three year study carried out at Moorepark comparing three different genotypes under three different feed systems was used for modeling the Moorepark site while an ongoing two year study being carried out at Ballyhaise comparing two groups of cows under two different feed systems was used for modeling data at the Ballyhaise site. The high durability cow from the Moorepark study was taken as being similar to the type of cow in Ballyhaise and to the type of cow on most Irish dairy farms.

Moorepark site

The Moorepark High Grass (MHG) system was based on cows being supplemented with approximately 350 kg of concentrate in the Spring and the remainder of the feed for the milking cows coming from grazed grass with a small portion of grass silage at the end of lactation. In the Moorepark High Concentrate (MHC) system, cows were supplemented with concentrate over the total lactation cumulating in a total 1,500 kg per cow. In both the MHG and MHC systems cows are turned out to grass by day in early February and by day and night from the end of February. Cows are managed on a rotational grazing regime with the entire farm grazed in the first rotation, which finishes in mid-April. Grass cover is monitored weekly and surpluses and deficits are identified with corrective action being taken. Nitrogen application occurs after each rotation with 300 kg/ha applied annually. Forty five percent and 35% of the farm is closed for first and second cut silage, which is harvested in late May and mid July respectively. Average farm grass cover is increased from mid August and by late September the cover reaches a peak of approx. 1,300-kg DM/ha. The last rotation starts on mid-October and grazing finishes in late November/early December. The breeding season starts in late April and finishes in late July a duration of thirteen weeks. Therefore there is a thirteen-week calving season starting on the end of January, with a mean calving date for the herd between the 10^{th} and 20^{th} of February.

Ballyhaise site

In the Ballyhaise High Grass System (BHG) cows are supplemented with approximately 650 kg of concentrate, while in the Ballyhaise High Concentrate System (BHC) cows receive 1,450 kg of concentrate, with the greatest proportion being fed in early and late lactation. The cows are turned out to grass by day in early March and by day and night in late March. Cows are managed on a rotational grazing regime. In the BHG system the whole farm is grazed in the first grazing rotation, finishing in mid April, while in the BHC system approximately 60% is grazed in the first grazing rotation. Grass cover is monitored weekly and surpluses and deficits are corrected as necessary. Nitrogen is applied after each rotation with 240 kg/ha being applied annually. Approximately 50% to 60% of the farm is harvested for first cut silage, with 30% of the farm harvested for second cut silage. The harvest date for first and second cut silage is similar to that at the Moorepark site. Grass cover is increased from mid August and by late September the covers peak at approx 1,100 kg DM/ha. The breeding and calving seasons are similar to Moorepark.

Maize silage feeding systems

There may be potential to increase milk production by using alternative high quality forage instead of concentrates. Experiments in Moorepark and elsewhere have demonstrated the potential of maize silage to increase intake and milk production, or alternatively to reduce the requirement for concentrates supplementation. Therefore, in a scenario of expanding milk production, purchased maize silage is considered as an alternative to purchased concentrate in terms of its effect on farm profitability. The costs associated with maize silage were based on a yield of 5 tonnes DM/acre for Moorepark with no plastic, while it a yield of 5.7 tonnes DM/acre with plastic was assumed for the Ballyhaise site

(Kavanagh, 2003). Maize silage costs include a land charge. In the analysis a response of 0.35 kg of milk per kg of Maize silage DM was assumed based on experiments at Moorepark. Based on this assumption a high Maize silage system was evaluated for both the Moorepark (MHM) and Ballyhaise (BHM) sites.

Results

Biological

Table 1 shows the milk production, liveweight, replacement rate and overall feed budget for the Moorepark and Ballyhaise sites. Milk yield was highest in the MHC system and was lowest in the MHG system. The response to increasing the level of concentrate supplementation at the Moorepark site from 350 to 1,500 kg/cow (i.e. going from the MHG to the MHC system) was approximately 1.0 kg of milk per kilogram of extra concentrate dry matter, while at the Ballyhaise site it was 0.7 kg of milk per kilogram of extra concentrate dry matter (i.e. going from the BHG to the BHC system). Milk protein concentration was highest at the Moorepark site, while milk fat concentration was highest at the Ballyhaise site. Seventy percent of the diet of the MHG system is composed of grazed grass while only 57% in the MHC system. The corresponding figures for Ballyhaise are 61% in the BHG and 50% in the BHC. The level of grass silage supplementation in both of the Ballyhaise systems were greater than both of the Moorepark systems as a result of the shorter grazing season.

Table 1: Milk production, liveweight, replacement rate, feed budget and the proportions of each feed in the diet for Moorepark and Ballyhaise feeding systems

	MHG	MHC	BHG	BHC
Milk Production				
Milk (kg/cow)	6,143	7,229	6,389	6,894
Fat (g/kg)	40.2	40.4	42.3	45.5
Protein (g/kg)	34.7	35.0	33.0	32.8
Lactose (g/kg)	46.8	46.8	45.3	45.6
Average live-weight (kg)	539	549	539	549
Feed Budget (kg DM/cow)				
Grass DM intake	3,679	3,313	3,372	3,020
Silage DM intake	1,288	1,174	1,554	1,678
Concentrate DM intake	309	1358	604	1291
Proportions of total DM				
Grass	0.70	0.57	0.61	0.50
Silage	0.24	0.20	0.28	0.28
Concentrate	0.06	0.23	0.11	0.22

Economic scenarios investigated

Four milk production scenarios were investigated at both sites:

1. EU milk quota applied at farm level where the consequence of higher milk (fat adjusted) production necessitated a reduction in cow numbers (S1). Therefore the purchase of milk quota was not possible.
2. EU milk quota applied at industry level (quota purchasing possible) with fixed cow numbers (S2). Therefore additional milk quota could be purchased but milk output could only be increased through increasing milk yield per cow with additional feeds.

3. EU milk quota applied at industry level (quota purchasing possible) with a fixed land base (S3). Therefore additional milk quota can be purchased and cows can be expanded up to a point where land becomes limiting.

4. EU milk quota applied at industry level (quota purchasing possible) with land available for expansion (S4). Therefore additional land can be rented, additional milk quota purchased and cow numbers increased. For the purpose of this analysis, expansion to the S3 level of milk sales was assumed.

Quota was purchased at a cost of €0.153 c/l (€0.70/gallon), which was financed over 5 years with the interest and capital considered an expense.

Table 2 shows the key assumptions used in the farm model for the four scenarios. The overall farm size in the model was 29.5 ha, with deficits and surpluses of land valued at an opportunity cost of €262/ha. The model farm was assumed to have a milk quota of 323,327l (71,120 gallon). All costs and prices were based on projections from FAPRI in the post decoupling era (Binfield et al., 2003). Concentrate cost was assumed to be €180/t in Moorepark and €205/t in Ballyhaise. The differences in concentrate costs were based on regional data from Monitor Farms. No cost was associated with the first 1.1 labour units, while any extra labour was considered as an expense and charged at €12.37 per hour. Farm net profit included total receipts less all other costs. It was assumed that there were 50 cow places available on the farm and when cow numbers increased over 50 conventional housing was constructed at a cost of €1,590 per cow. The cost of purchasing additional cows was financed over a 5-year period with the interest portion of the loan considered an expense.

Table 2: Assumptions used in the model farm.

	Moorepark	Ballyhaise
Farm size (ha)	29.5	29.5
Quota (kg)	323,327	323,327
Reference fat (g/kg)	36	36
Gross milk price (c/kg)	22.3	22.3
Price protein to fat	2.00	2.00
Replacement Heifer price (€)	1,397	1,397
Reference cull cow price (€)	270	270
Reference male calf price (€)	102	102
Labour cost per unit (€/month)	1,905	1,905
Concentrate costs (€/tonne)	180	205
Opportunity cost of land (€/ha)	262	262
No. of Cow places on the farm	50	50
Concentrate Cost (€/tonne)	180	205
Maize Silage Cost (€/tDM)	105	120

At both the Moorepark and the Ballyhaise sites, the MHG and BHG in S1 scenario were used as the control systems respectively i.e. each other system was compared to this system. Therefore at both sites, it was possible to investigate the economic consequences of opting for a higher concentrate or a high maize supplementation system under a variety of scenarios.

Economic Analysis

The Moorepark Dairy Systems Model (Shalloo *et al.,* 2004), which is a stochastic budgetary simulation model, was used to simulate the model farms by integrating biological and financial data from each site. Table 3 shows the key herd output parameters from the model for the Moorepark site for each of the four scenarios and for each of the three feeding systems.

Where milk quota was fixed (S1) the farm profit from the MHG system was €2,617 and €1,279 more than the MHC and the MHM systems respectively. The margin per cow was highest with MHC and was lowest with the MHG system while margin per kilogram was highest for the MHG system.

Where milk quota purchasing was possible and cow numbers were fixed (S2) the MHG system returned €1,079 and €503 higher farm profit than the MHC and the MHM systems respectively, when the additional labour was charged. If the additional labour was not charged then there was an advantage of €3,086 and €994 to the MHC and MHM systems respectively. In the MHG and MHM systems 53,562 and 19,257kg (11,442 and 4,114 gallons) of additional milk quota were purchased/produced respectively.

Where milk quota purchasing was possible and land was limiting (S3) the MHG system was €770 more profitable than the MHC, while it was €137 less profitable than the MHM system, when additional labour was charged. If the extra labour was not charged then there was an advantage of €5,662 and €6,432 to MHC and MHM systems respectively. In the MHC and the MHM systems 82,724 and 81,251kg (17,672 and 17,357 gallons) of additional milk quota were purchased over the MHG system.

Where milk quota purchasing was possible and land was available for expansion (S4) (a similar amount of quota was purchased as in S3) the MHG system returned €931 more farm profit than the MHG system in the S1 scenario or €7,277 where extra labour was not charged.

Table 3: Key herd output parameters at the Moorepark site in a fixed quota scenario (S1), in a scenario with fixed cow numbers and quota leasing (S2), in a of limited land area with quota leasing (S3) and in a scenario where land is available (S4) for a high grass (MHG), high concentrate (MHC) and high maize silage (MHM) system.

	S1			**S2**		**S3**		**S4**
	MHG	MHC	MHM	MHC	MHM	MHC	MHM	MHG
Milk Price	24.0	24.5	24.2	24.5	24.2	24.5	24.2	24.0
Total hectares used	19.6	15.3	15.4	18.1	16.4	19.6	19.6	24.9
Quota lease (kg)	-	-	-	53,562	19,257	82,724	81,251	81,308
# Cows calving	49.4	41.9	46.4	49.4	49.4	53.5	59	62.8
Livestock units (LU)	46.3	39.3	43.5	46.3	46.3	50.2	55.3	58.9
Stocking rate (LU/ha)	2.37	2.57	2.82	2.57	2.82	2.57	2.82	2.37
Milk produced (kg)	306,806	302,688	305,158	357,127	324,762	386,767	387,873	389,667
Milk sales (kg)	301,055	297,815	299,755	351,376	319,012	380,539	381,006	382,362
Fat sales (kg)	11,990	12,027	12,005	14,190	12,777	15,368	15,259	15,228
Protein sales (kg)	10,328	10,420	10,340	12,294	11,004	13,314	13,142	13,118
Milk returns (€)	72,378	72,957	72,491	86,078	77,148	93,222	92,140	91,926
Livestock sales (€)	13,586	11,513	12,764	13,584	13,584	14,712	16,224	17,255
Feed costs per kg milk	3.74	5.62	4.76	5.62	4.76	5.63	4.76	3.74
Total costs (€)	55,382	56,506	55,992	70,159	60,697	78,121	77,700	77,755
Margin per cow (€)	619	668	631	597	609	557	521	502
Margin per kg milk (cents)	9.97	9.24	9.60	8.27	9.26	7.71	7.92	8.08
Single Farm Payment (€)	-	-	-	-	-	-	-	-
Labour Costs (€)	-	-	-	4,165	1,497	6,432	6,295	6,346
Farm Profit (€)	**30,582**	**27,965**	**29,303**	**29,503**	**30,079**	**29,812**	**30,719**	**31,513**

Table 4 shows the effect of variation in concentrate costs and the effect of the concentrate price (c/kg) to the milk price (c/kg) ratio on farm profitability for the Moorepark site. The analysis shows that concentrate cost would have to reduce to approximately €115 and €160 in S1 and S2 scenarios respectively before the MHC system was more profitable than the MHG system. Where milk quota purchasing was possible and land was available for expansion (S4) the MHG system is more profitable than the MHC (S3) system when concentrate cost was higher than €140/tonne.

Table 4: Variation in concentrate costs on farm profitability for different milk production scenarios at the Moorepark site.

		S1		S2	S3	S4
Concentrate Price	Concentrate Milk price Ratio	MHG	MHC	MHC	MHC	MHG
Base - €60/tonne	0.67	**31,573**	31,546	33,729	34,390	**32,773**
Base - €40/tonne	0.76	**31,243**	30,352	32,320	32,864	**32,353**
Base - €20/tonne	0.85	**30,912**	29,158	30,911	31,338	**31,933**
€180/tonne	0.94	**30,582**	27,965	29,503	29,812	**31,513**
Base + €20/tonne	1.04	**30,252**	26,770	28,094	28,287	**31,093**
Base + €40/tonne	1.13	**29,921**	25,576	26,685	26,761	**30,674**
Base + €60/tonne	1.22	**29,591**	24,382	25,276	25,235	**30,254**

Table 5 shows the key herd output parameters from the model for the Ballyhaise site for each of the same four scenarios (S1, S2, S3, S4) and for each of the three feeding systems (BHG, BHC, BHM).

Where milk quota was fixed (S1) the farm profit from the BHG system was €4,709 and €1,521 more than the BHC and the BHM systems respectively. The margin per cow was highest with BHG while margin per cow and margin per kilogram were lowest with the BHC system.

Where milk quota purchasing was possible and cow numbers were fixed (S2), the BHG system returned €3,602 and €1,095 higher farm profit than the BHC and the BHM systems respectively, when the additional labour was charged. If the additional labour was not charged then there was a loss of €548 and a gain of €69 in the BHC and BHM systems respectively compared to the BHG system. In the BHC and the BHM systems 42,061 and 14,996kg (8,985 and 3,203gallons) of additional milk quota were purchased respectively.

Where milk quota purchasing was possible and land was limiting (S3) the BHG system was €3,103 and €599 more profitable than the BHC and BHM systems respectively, when additional labour was charged. If the extra labour was not charged then there was an advantage of €1,412 and €4,817 to BHC and BHM systems respectively. In the BHC and the BHM systems 62,055 and 69,659kg (13,256 and 14,881gallons) of additional milk quota were purchased over the BHG system.

Where milk quota purchasing was possible and land was available for expansion (S4) (a similar amount of quota was purchased as in S3) the BHG system returned €646 more farm profit than the BHG system in the S1 scenario or €6,071 extra profit where extra labour is not charged.

Table 5: Key herd output parameters at the Ballyhaise site in a fixed quota scenario (S1), in a scenario with fixed cow numbers and quota leasing (S2), in a of limited land area with quota leasing (S3) and in a scenario where land is available (S4) for a high grass (BHG), high concentrate (BHC) and high maize silage (BHM) system.

	S1			S2		S3		S4
	BHG	BHC	BHM	BHC	BHM	BHC	BHM	BHG
Milk Price	24.1	24.7	24.1	24.7	24.1	24.7	24.1	24.1
Total hectares used	19.4	15.7	15.8	18.2	16.6	19.4	19.4	24.1
Quota lease (kg)	-	-	-	42,061	14,996	62,055	69,659	69,601
# Cows calving	45.7	39.5	43.4	45.7	45.7	48.5	54	56.8
Livestock units (LU)	42.9	37.0	40.7	42.9	42.9	45.6	50.7	53.3
Stocking rate (LU/ha)	2.22	2.35	2.59	2.35	2.59	2.35	2.59	2.22
Milk produced (kg)	292,020	272,274	291,225	315,058	306,486	335,395	362,114	362,912
Milk sales (kg)	286,700	267,677	286,170	309,738	301,166	329,732	355,828	356,301
Fat sales (kg)	12,126	12,196	12,129	14,112	12,765	15,023	15,082	15,069
Protein sales (kg)	9,500	8,797	9,491	10,180	9,989	10,837	11,802	11,806
Milk returns (€)	69,010	66,168	68,990	76,565	72,604	81,508	85,782	85,764
Livestock sales (€)	12,568	10,860	11,942	12,567	12,568	13,378	14,849	15,619
Feed costs per kg milk	4.78	6.55	5.34	6.55	5.78	6.55	5.78	4.78
Total costs (€)	56,223	56,383	57,098	67,379	60,904	72,341	75,875	75,340
Margin per cow (€)	555	523	549	476	531	459	458	459
Margin per kg milk (cents)	8.69	7.58	8.19	6.91	7.91	6.66	6.83	7.17
Single Farm Payment (€)	-	-	-	-	-	-	-	-
Labour Costs (€)	-	-	-	3,054	1,164	4,515	5,416	5412
Farm Profit (€)	**25,355**	**20,646**	**23,834**	**21,753**	**24,260**	**22,252**	**24,756**	**26,044**

Table 6 shows the effect of variation in concentrate costs and the effect of the concentrate price (c/kg) to the milk price (c/kg) ratio on farm profitability for the Ballyhaise site. Table 6 shows that the BHC system is less profitable than the BHG system even at a concentrate cost of less than €145/tonne in the S1, S2 and S3 scenarios respectively. When land area for grazing is available with quota purchasing (S4), the BHG is more profitable until concentrate cost is reduced to €115/tonne when compared to the BHC system in S3.

Table 6 shows the effect of variation in concentrate costs on the profitability of the high and low input systems for Ballyhaise.

		S1		S2	S3	S4
Concentrate Price	Concentrate Milk price Ratio	BHG	BHC	BHC	BHC	BHG
Base - €60/tonne	0.55	**27,092**	23,839	25,447	26,175	**28,210**
Base - €40/tonne	0.64	**26,513**	22,774	24,216	24,866	**27,482**
Base - €20/tonne	0.73	**25,935**	21,710	22,985	23,559	**26,763**
€205	0.83	**25,355**	20,646	21,753	22,259	**26,044**
Base + €20/tonne	0.92	**24,777**	19,582	20,522	20,945	**25,324**
Base + €40/tonne	1.01	**24,199**	18,518	19,290	19,639	**24,605**
Base + €60/tonne	1.10	**23,620**	17,454	18,059	18,332	**23,886**

Implications

It has been shown from previous studies that dairy farmers need to expand and/or increase the efficiency of their dairy operation to maintain their real farm incomes over the coming years (Breen and Hennessey 2003). It is likely that land purchase price will continue to be high in future years. Dairy farmers can continue at their current level of production and efficiency, and suffer a decline in farm profit as milk price falls. It is likely that greater amounts of milk quota will become available in the coming years; therefore many dairy farmers will have the option to increase production. Expansion opportunities will be limited by key constraints such as labour supply and cost, capital cost, milk quota availability and price and availability of land around the milking parlour. Labour efficient work practices will have to be adopted on farms to allow one operator to manage a higher number of cows. All expansion options will have to be based on low cost capital structures. Setting the price of milk quota for a number of years would allow dairy farmers who are buying milk quota to plan ahead. The results of this paper suggest that there are also regional concerns for dairy farmers.

The results of the present analysis indicate:

- The most profitable spring milk production system in both Moorepark and Ballyhaise environment (in both a milk quota and non quota scenario) is where grazed grass is maximised in the diet.

- The profitability of systems of milk productions based on high concentrate /high maize silage systems will be very much influenced by milk: supplement price ratios. Using present day concentrate prices and projected future milk prices there is very little to be gained financially by changing to a high concentrate/high maize silage feeding system when full labour cost is charged.

- Increased labour efficiency is needed in all the expansion scenarios investigated to increase farm profit. The analysis shows that an increase in labour efficiency of 27% following expansion will increase farm profit by 24%. (MHG, S1 vs. MHG, S4)

- The large difference in farm profit between the Moorepark and the Ballyhaise site emphasises the importance of the length of the grazing season.

- In all the analyses carried out, grazing management was at the same level of efficiency in all three feeding systems (high grass, high concentrate and high maize). This may not be the case on most dairy farms because generally grazing efficiency reduces in high supplementation situations especially with forage supplementation.

- On farms limited by land availability, options to increase the cow grazable area should be investigated before looking at high input systems. Such options include land leasing, land swapping and or dairy farm partnerships.

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Expansion in Northern Ireland

Ian McCluggage, Head of Dairy & Pigs, Greenmount College, Co. Antrim

The title given to me for my presentation was "Expansion in Dairy Farming in Northern Ireland". In this paper I will try to identify the key drivers behind the significant changes, which have occurred within Northern Ireland dairy farming, since milk quotas were introduced. I will use this information to see if there are lessons to be learnt, which may be applicable to the dairy sector in Republic of Ireland and help you approach the new era in farming post MTR with confidence.

As I mention MTR I will provide some background as to its implementation in Northern Ireland as there are differences with the approach taken compared to other United Kingdom regions. This will undoubtedly bring change but change is nothing new nor is it to be feared. Agriculture and particularly dairy farming is a dynamic and changing industry it has been and will continue to be so. Structural change is not a new phenomenon. Review the statistical data for any farming industry in Western Europe and this is clearly evident.

However, what is worth noting is the pace of change. In business it is not possible to stand still. If you do so, one of two things will happen. Either the business will be overtaken by the competition, become non-viable and cease production. Or if sufficient financial reserves have been built up and the owner enjoys being part of the business world, it will remain as a hobby but unlikely to be passed on as a profitable and sustainable business to the next generation.

Change is part of everyone's life, it is a challenge and how you approach and deal with the challenge will dictate the level of success achieved.

Agriculture in Northern Ireland and indeed throughout Europe is about to face significant change as a result of the Mid Term Review of the Common Agricultural Policy. In Northern Ireland from 1st January 2005 support to farming will be decoupled, breaking the link between production and the financial payments received in the form of livestock or arable subsidies. The new era means that future farm profitability will be dictated by the returns from the market place. Farmers must make decisions on the scale and system of milk production based on market demand.

The Single Farm Payment on dairy farms is potentially made up of three elements. Firstly the historic reference amount based on the livestock subsidies and arable aid payments received in the years 2000-2002. Secondly, the flat-rate element calculated on the area on which entitlements are to be established on the 2005 IACS. The third part of the SFP is the payment, which will be made against milk quota held at 31st March 2005. These three elements will be amalgamated into the Single Farm Payment and allocated to an area of land thus creating entitlements. The SFP which dairy farmers will receive is intended to partly compensate for an anticipated fall in milk price arising from cuts in intention support price for milk products. As the dairy industry in the Island of Ireland has been heavily dependent upon butter and skim milk powder the cuts in intervention support are likely to be felt more acutely than other EU countries where there is less reliance on commodity world markets.

Background to Northern Ireland Agriculture

Agriculture in Northern Ireland is three times more important to the economy, accounting for 2.5% in 2003 of Gross Value Added (GVA) as compared to the United Kingdom as a whole. In Republic of Ireland the equivalent figure for agriculture as a percentage of GVA is 3% highlighting the importance of agriculture both the North and South of the Ireland.

In Northern Ireland the total agricultural area is just over 1 million hectares equating to 80% of told land area, with 70% of the 1 million hectares classified as LFA. The total number of farm businesses is just over 28,000 and is 6% less than in 2000. Average farm size is currently 38 hectares slightly larger than Republic of Ireland at 32 hectares, but significantly smaller than the

United Kingdom where average farm size is 56.5 ha, Conacre land attributes for a third of the land farmed annually in Northern Ireland and has enable some farms to expand without the capital investment in land purchase. It is anticipated conacre values will fall post MTR allowing those who wish to expand to do so at more competitive land prices.

Of the 28,000 farms in Northern Ireland only 3,710 or 13% are classified as medium or large businesses with 2,633 of these dairy farms. Dairy farming provides on-farm employment for approximately 10,000 people including dairy farmers, other family members and employees. It produces added value of over £170 million annually. In addition the dairy herd produces 80% of the milk used by the Northern Ireland milk-processing sector, which employs over 2,300 people and contributes added value of £70 million annually to the Northern Ireland economy. When the supply of inputs e.g. feed, fertilizer, machinery, equipment etc is also taken into account it is evident that the dairy sector contributes to more than the £240 million added value each year. Therefore the ability of Northern Ireland dairy farmers to compete successfully has a significant impact beyond the farm gate in terms of employment and added value to the economy.

The Structure of Dairy Farming in Northern Ireland

In 1984 when milk quotas were introduced there were 8,083 dairy farms with an average herd size of 37 cows, producing on average 4,630 litres per cow. Over the next 10-year period, the total number of dairy cows reduced by 25,000 to stand at just over 270,000. There were almost 2,000 less dairy farms equating to on average 200 dairy farms leaving the industry each year. Average herd size and milk yield per cow only increased marginally to 44 cows and 4,930 litres respectively.

Northern Ireland had an initial milk quota allocation of 1,322m litres. However due to EU imposed cuts by 1993/94 the regional quota had fallen to 1,283m litres. Farmers had opted for a grass based production system seeking to maximise margin per litre. However with pending deregulation of milk marketing and the strengthening of milk price dairy farmers sought to increase output from the dairy herd. The availability of milk quota particularly from England coupled with positive encouragement from milk processors significant quantities of milk quota were purchased. Specific loans from either the banks or milk processors were set up with repayments periods over 5 years at 1% over bank lending rate readily offered to dairy farmers wishing to expand. For the 2003/04 milk quota year the volume held by Northern Ireland dairy farmers is just over 1,760m litres reflecting a 37% increase since the 1993/94 milk quota year. Whereas in the previous 10-year period only small increases had been recorded in herd size and milk yield the period 1994-2003 significant changes at farm level have occurred. Herd size increased year on year by on average of 1.5 cows with herd size now standing at 61 cows while milk yield per cows average 6,290 litres across all herds and this data is summarized in Take 1.

Table 1. Number and size of dairy farms in Northern Ireland 1984-2003

	1984	**1993**	**2003**
Total Number of Dairy Farms	8,083	6,179	4,742
Total Number of Dairy Cows'000	298	273	291
Average Herd Size	37	44	61
Average Milk Yield Per Cow (l)	4,630	4,930	6,290

There is a wide range in herd size in the Province with 186 farms milking 9 cows or less but 80 farms now milking 200 cows or more. The definite trend is towards fewer farms with larger herds and is highlighted in Table 2. For the last full year of data the 773 largest dairy farms produced more milk than the 3,194 "smallest". Some time should be taken to reflect on this as the implications for future development within dairy farming are socially and economically far reaching.

Table 2. Distribution of Farms and Dairy Cows in Northern Ireland 2003

Herd Size	Number of Farms	Number of Cows	% Change in number of farms 1993-2003
1-19	622	7,448	-53
20-49	1,729	59,349	-42
50-69	843	48,921	-3
70-99	775	63,273	+22
100+	773	111,154	+110

As dairy farms specialize and get larger it puts into perspective the challenges, which must be addressed in developing social and economic policies in line with EU initiatives even within a small EU region like Northern Ireland. While average herd size has increased by 1.5 cows in Northern Ireland over the last 10 years the rate of increase has varied across countries. Just over 12% of dairy farms in Co Fermanagh milk 70 cows or more and the County has an average herd size of 39 cows. While in Co Down average herd size is almost 80 cows and 48% of the herds in the County milk 70 cows or more

Why has Northern Ireland dairy farming recorded such expansion?

Some of the main factors, which have contributed to the increase in output at farm level are given below. These may provide an explanation as to how expansion has taken place and pointers for those considering expansion in future years.

- A milk quota regime in the United Kingdom allowing quota trading.
- The availability of milk quota from mainland UK with farmers ceasing production.
- Positive encouragement from milk processors to increase output.
- Expansion funded out of farm profits.
- Favourable borrowing terms from several sources of finance.
- Economics of scale for the best use of on-farm resources.

- Land prices limiting increase in farm size, dictating increased output per cow.
- Availability of “grazeable acres” within easy access of the milking parlour.
- Milk Price / Meal Price Ratio improving the economics of meal feeding.
- Competitive costs of alternative compared to grazed grass.
- Dairy cows genetics.
- The cost of marginal litres of production.
- Flexible and adaptable management systems.

Benchmarking

At the request of key opinion leaders within the industry, Northern Ireland dairy farmers themselves and the Ulster Farmers Union, Greenmount developed a dairy benchmarking program for use by all dairy farmers in the Province. The program is simple and straight-forward to use. It allows farmers to quickly and easily identify the strengths and weaknesses of their own farm business when compared to farms of similar scale and production system as well as “best-in-class” industry standards.

The information presented at the Conference will use data from these benchmarked farms to demonstrate the level of expansion and development, which is possible. Therefore it needs to be noted these farms are not representatives of the whole Northern Ireland dairy farming sector as Greenmount predominately works with the farmers who wish to develop and go forward. Benchmarking has been available since 1999 and a considerable number of farms have used the system each year. These form a valuable resource as “core” farms, where trends can be quickly noted regarding development at farm level year on year.

Over the last six years these common or “core” farms have increased herd output by almost 35% through a combination of more cows and higher milk yield per cow. This is despite a collapse in spring milk price and the difficulties presented by atrocious weather conditions during the summer and autumn of 2002. Remember also as dairy farming is a cycle there was a carry over of the effects of the very poor weather into 2003 as evidenced by both grazing and silage sward damage and poor cow condition.

What if these farms had not expanded? If the herds had maintained output at 1999/00 levels compared to 2003/04, herd profitability would be almost £14,000 less at £39,450 compared to £53,400. Even assuming costs of production could be reduced by 1ppl on these already efficient farms herd profitability would still be £8,700 less.

As is clearly evident the availability of milk quota has allowed the on–farm expansion of milk production in Northern Ireland. But what is the impact on profitability depending on different limiting resources. To answer this question I have considered the results from benchmarked farms who are in the top 10% of their chosen system of milk production i.e. a spring calving grass based system or a high input high output autumn calving system. The efficiency targets set for each system are listed below.

	Spring Calving Grass Based	**High Input / High Output**
Milk Yield (l)	6,000	12,000
Concentrate Feeding (kg)	250	3,000
Stocking Rate CE/Ha	2.5	2.8
Total Costs of Production ppl	8	11

However to date these challenging targets have not been achieved. The results from the top 10% of dairy farms on benchmarking are 5,600 litres from 600 kilos and 9,800 litres from 2,800 kilos of concentrate feeding for the two systems. Table 3 summarizes the financial performance of these systems at a milk price of 17ppl (25c / l at current exchange rate).

Table 3. The Financial Performance of Dairy Systems

	5,600 l	**9,800 l**
	Milk Price 17ppl	
Output	890	1,565
Variable Costs / Cow	275	663
Variable Costs / Litre	4.9	6.8
* Overhead Costs / Litre	4.0	4.5
Profit / Litre	8.1	5.7
To generate £25,000 require		
Milk Quota (litres)	309,000	439,000
Herd Size (cows)	55	44

*** excluding own and family labour**

The results in Table 3 shows that grass based systems maximize margin per litre. But I pose the question do grass based systems maximize farm profit and allow expansion of the farm business? The answer I feel depends on what is the farm's most limiting resource.

What is limiting expansion in milk production?

If this question had been asked several years ago many farmers would have replied milk quota. However this would no longer be applicable and it is more likely the answer in Northern Ireland is the availability of grazeable acres easily accessible to the dairy unit. Increasingly two other factors are limiting expansion and must not be ignored. Firstly the lack of quality labour for dairy herd management.

Secondly and presently occupying the thoughts of many dairy farmers is current and pending environmental legislation linked to the Nitrates Directive, which may put a stocking rate limitation as a result of N output per dairy cow. It is not possible to provide any further analysis on this topic as the Nitrates Action Plan is not published in Northern Ireland.

Using the data from the top 10% of farms in each system and the economic principle of maximize output to the most limiting resource the following conclusions can be made.

- ❖ Only where milk quota is the most limiting resource is herd profitability increased under the grass based system.
- ❖ Where land is limiting, profitability can be increased by over 20% by opting for more milk output per cow.
- ❖ At 170 kg of N per hectare, where cow numbers will be limited then the high output system produces the most profit per herd.

Know your costs of milk production

The results from benchmarking show a wide variation in performance and emphasize the importance of knowing the costs of production at individual farm level. Industry averages are useful as trend indicators but no farm business planning for a secure, profitable and sustainable future should use anything less than their own herd and farm performance results. Do not sail out to far from the safety of the shoreline on the bank's boat based on industry averages – you do so at your own peril!

A survey conducted by the RABDF at this year's Dairy Event in September 2004 indicated that two-thirds of milk producers in England and Wales do not know the costs of production. This is no way to plan ahead particularly when key decisions need to be taken on for example the use of the Single Farm Payment within the farm business or whether it is worth investing to comply with environmental legislation standards. This is why in conjunction with dairy farmers who had completed benchmarking and were wanting to develop the farm further, Greenmount developed the Business Challenge for Dairy Farmers. The "Challenge" deals with such issues as the differences between cash and profit, planning for profit and growth of the farm and financing development and expansion.

The results from Greenmount Benchmarking show a wide range in both physical and financial performance as highlighted by these few figures listed and emphasise the importance of understanding business management. Milk sales per cow per year varies from 3,810 – 10,150 litres, concentrate feeding 175 – 4,100 kilos and profit per litre ranging from –2 to 10ppl demonstrating the need for farmers to know their own farm business situation. When the results are studied in detail the following points can be made regarding successful development of the dairy business.

- ❖ A focus for year on year growth of the farm business.
- ❖ Increased specialisation recognising the need to develop the necessary business skills to manage such farms.
- ❖ Greater use of contractors for all farm activities including, slurry spreading, silage making, fertilizer application, calf / heifer rearing and contract growing of alternative forages.
- ❖ Benchmarking highlights a 4ppl differential in the value of milk sold so increased focus on breeding, feeding and herd management to improve components.
- ❖ The relative value of feed inputs particularly in light of the quantity and quality obtained from alternative forage production.
- ❖ Farmers must target top 25% performance – there is no future in below industry average performance.
- ❖ If your farm cannot achieve better than average performance or you view “the glass as half empty” seek another career over the next 2 – 3 years.
- ❖ When growing the business focus on investments giving the best return on time and money.
- ❖ No business can stand still, the business will either be left behind or die.
- ❖ Encourage “new thinking” onto your farm with “new blood” with drive, determination, initiative and innovation to tackle the issues of product quality, labour efficiency, environmental legislation and lifestyle.
- ❖ If you are managing a profitable but mature business invest off-farm to improve business wealth creation for the future, but enjoy and be interested in this off-farm investment.

- Adopt a positive realistic approach to your dairy farm business enjoying what you do.
- Farming will face new challenges but develop your farm business with confidence.
- Invest time and money in your family and yourself.

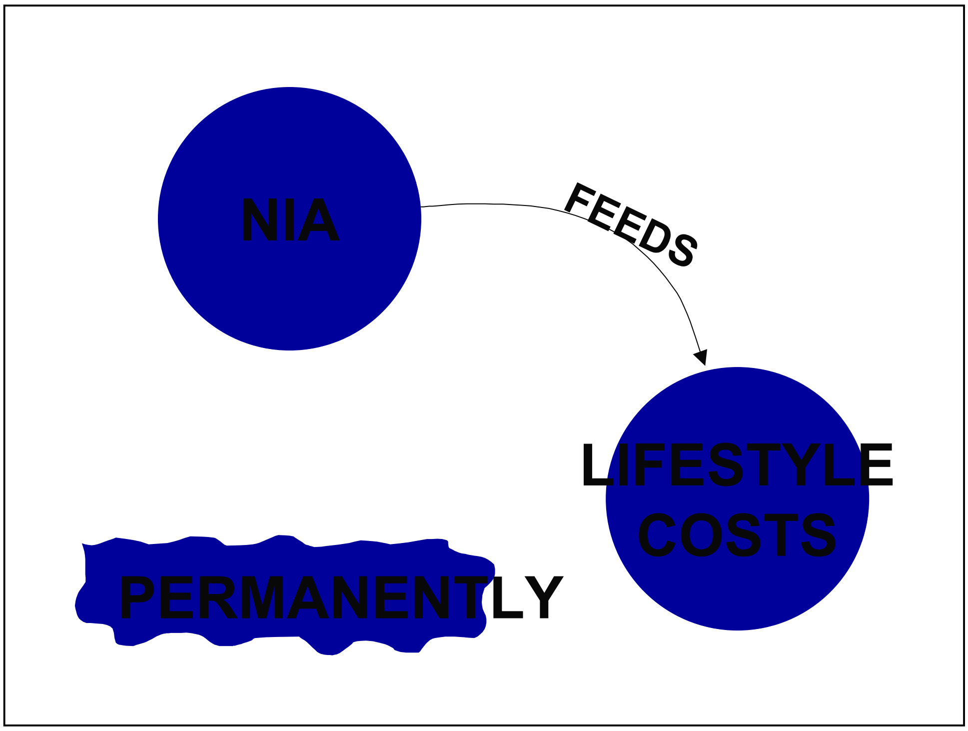
Money Management

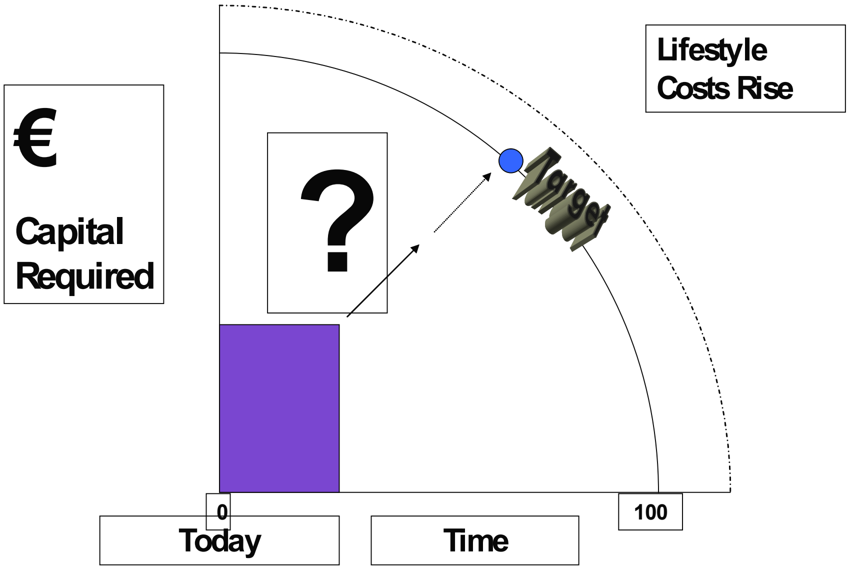
Eddie Hobbs, Financial Consultant and presenter of 'Show Me the Money', RTE

THE JOB IN HAND

BECOME FINANCIALLY INDEPENDENT

BUT WHAT DOES THIS MEAN?

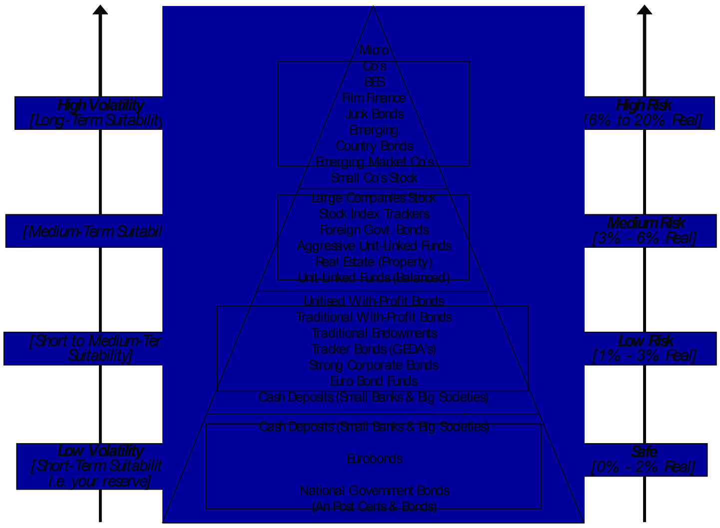




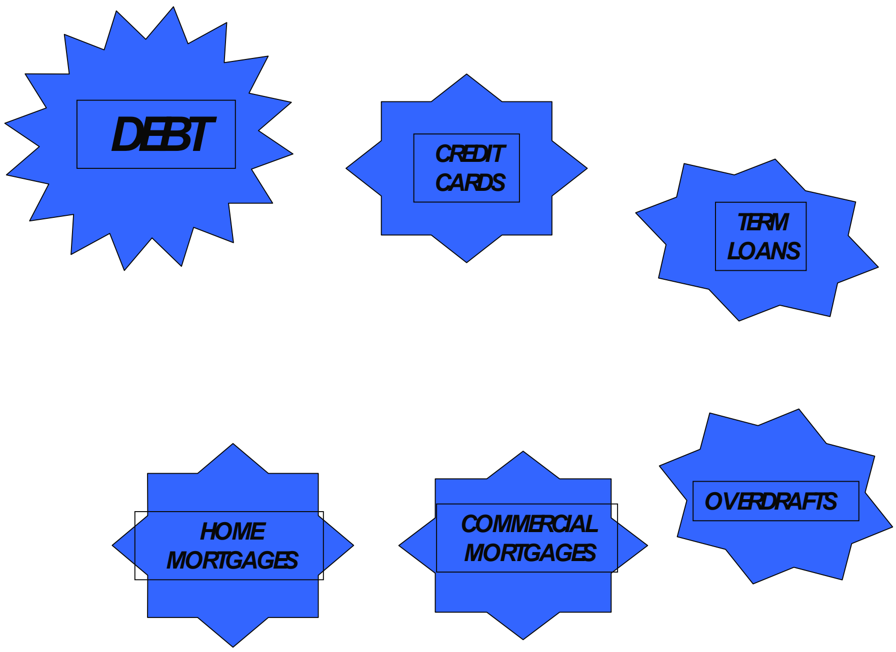
WHAT YOU MUST EARN TO STAND STILL

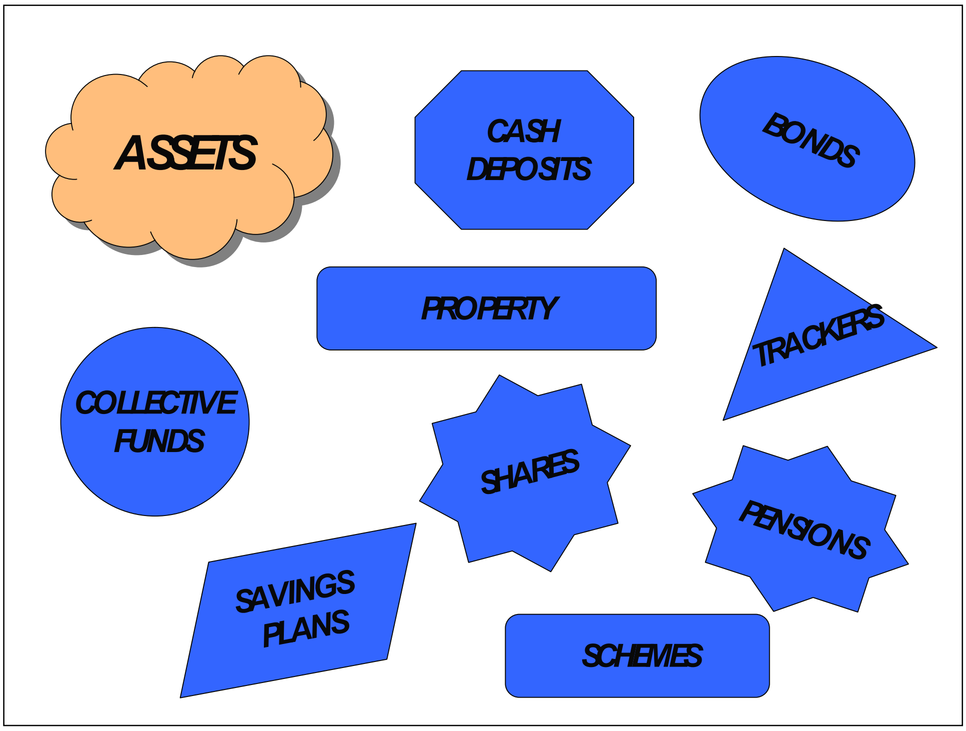
Tax Rate	Inflation Rate 2%	3%	4%	5%	6%	7%	8%	9%
0%	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
10%	2.2	3.3	4.4	5.6	6.7	7.8	8.9	10.0
15%	2.4	3.5	4.7	5.9	7.1	8.2	9.4	10.6
20%	2.5	3.8	5.0	6.3	7.5	8.8	10.0	11.3
25%	2.7	4.0	5.3	6.7	8.0	9.3	10.7	12.0
30%	2.9	4.3	5.7	7.1	8.6	10.0	11.4	12.9
35%	3.1	4.6	6.2	7.7	9.2	10.8	12.3	13.8
40%	3.3	5.0	6.7	8.3	10.0	11.7	13.3	15.0
45%	3.6	5.5	7.3	9.1	10.9	12.7	14.5	16.4

THE INVESTMENT PYRAMID



* *Collective investments such as Unit Linked Funds, Unit Trusts and Open-Ended Investment Companies (OEIC's) provide packaged products that invest in different parts of the pyramid.*



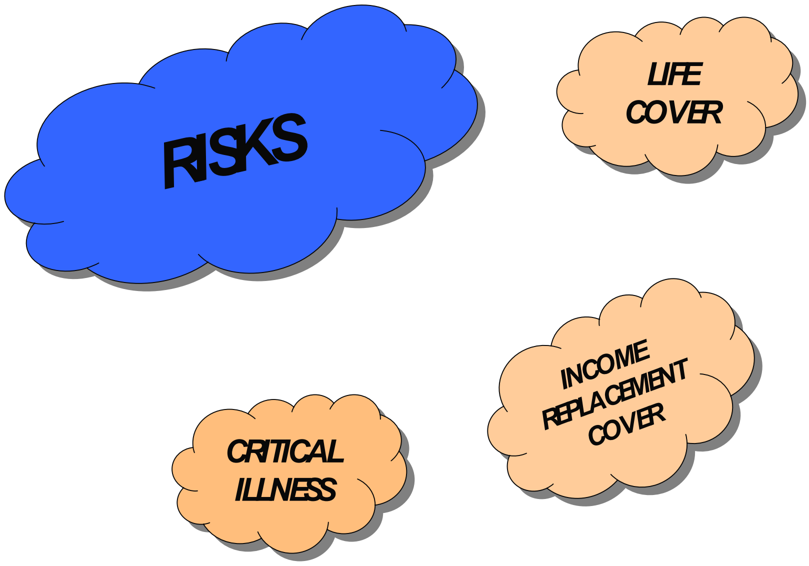


THE 'BEAR' FACTS – TIME NOT TIMING

SELECTED US BEAR MARKETS SINCE 1875

Peak Date	Trough Date	Duration (mths) of Fall	% Change	% Change + 1Yr	% Change + 5 Yr
Apr 1875	Jun 1877	26	-41.3	24.9	108.1
Jun 1881	Jan 1885	43	-35.6	22.6	26.9
Sep 1929	Jun 1932	33	-84.8	117.8	227.9
Apr 1946	Jun 1949	38	-25.1	34.1	107.3
Jan 1973	Dec 1974	23	-43.4	32.2	60.7
Nov 1980	Jul 1982	20	-19.4	52.7	183.5
Aug 1987	Dec 1987	4	-26.8	14.7	80.8
Jun 1990	Oct 1990	4	-14.8	26.0	89.8
Apr 2000	Sep 2001	18	-31.3		
Average		18	-32.7	34.5	79.5

Since 1875 the average US bear market has lasted 18 months and produced a 32.7% fall from peak to trough.



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Expansion through Partnership

Tony Barrett, Mullinahone, Co. Tipperary

I took over the management of the home farm with 180 acres and 120,000 gallons quota in January 2001. I had the help of one full-time worker for most of the year. However, when he left I had to think of how I might manage in the future, particularly with 140,000 gallons +.

I spoke with a neighbour of mine, Noel Guiry, who has 130 acres and a 40,000-gallon milk quota, about entering into a partnership with me. He agreed that it would be well worth investigating. We got an independent consultant to value the assets of both farms to arrive at a profit sharing ratio. We both agreed that we should go ahead.

1. We got a new herd number
2. We opened a joint partnership bank account

We now have 160,000-gallon milk quota produced by 145 cows, all spring calving. All calves are reared. On the financial side, all labour costs are eliminated.

Our ability to be on top of our work leads to all round greater efficiency. There is a considerable saving on some fixed costs e.g. bulk tank, milking equipment

Advantages of a Better Lifestyle Through Partnership

There is a much better lifestyle and security of labour. Time off is more flexible in our situation.

Is every second weekend off which means from Friday evening till Monday morning the partner is free to relax etc.

Holidays work out about 2 weeks a year, which can be taken anytime once out of the main calving season or other busy periods e.g. 1st cut silage. But as a whole, time off or even a day off is usually no problem once notice is given. It is a good system and has improved lifestyle greatly.

Expansion

Expansion is something we look forward to as we have the manpower and main facilities on hand. The only thing is extra quota, no doubt that will come in due course.

Expansion from a Green Field

John Dunne, Dairy Farmer, Mitchelstown, Co. Cork

Introduction

I come from near Mitchelstown, Co Cork and have been farming full time for the past 7 years. Our home farm is operated as a family unit with my parents and brother Conor.

I completed my Teagasc Certificate in Farming in 1998 having attended Rockwell Agr. College and Reaseheath College in Chesire in England (Dip Dairy Herd Management 1997) and did my placement on Michael Downings farm near Cork city.

When I stayed at home our farm was well developed with 80 cows milking 1250 gals per cow. We had a substantial beef enterprise of 30 suckler cows and all cattle were finished to heavy weights.
The home farm is fragmented into 4 blocks.

We became a monitor farm under the Dairygold/Teagasc joint programme in 2000, this set us a focus of improving milk protein and analysing our costs and margins in an structured manner.

Dairying was the business we wanted to be in and I personally wanted to utilise my training and harness our strengths by expanding the dairy enterprise.

Development

Private leasing of quota's had effectively finished in 1999 and we had to look at other options. Partnerships were out for us because of size and age restrictions, not because we couldn't get along.

It became clear that I would have to set up an independent dairy unit on one of our holdings to utilise the skills, talent and labour resources that we had.

How would we go about this?

Having spoke with Billy Kelleher our Monitor Farms advisor and Paddy Crowley our Teagasc advisor along with Noel Coughlan of Dairygold we had the basics of a plan to get started.

I needed the following to get started to qualify for an allocation of milk under the new entrant restructuring scheme:-

1. a herd No.
2. a lease on land.
3. an existing quota
4. a milking premises
5. Cows

A disused milking parlour was already in place on one of our outfarms and this plus some land on that farm could be used to set up a lease and establish a herd.

Getting some quota in my name would prove to be the most difficult part of the development. The obvious route would have been to lease a small amount of the home quota as a starter, but this would rule the home farm out of temporary leasing and restructuring allocations.

Leasing of quotas under the original Early Retirement Scheme was still allowed and our opportunity arose when I followed up a press advertisement in April 2002 for such a quota. I leased 15,000 gallons on 22 acres, eleven miles from my new dairy unit for 5 years.

The facilities on the out farm were as follows.

a) Milking parlour for 8 units.
b) 45 cubicles
c) meal bin

d) silage and slurry pit
e) paddocks, roadways and water supply.

The costs of getting all facilities in place were

i) Installing second hand machine	€8,870
ii) Electricial wiring of the facilty	€1,800
iii) Milk tank	€4,500
Total	**€15,170**

All we were now short of was cows. These were bought at two dispersal sales and I was up and running by mid June 2002.

Table 1 below shows my cow numbers and production over the the first 3 years.

Table 1: Cow no's and milk supply 2002 - 2004

	2002	2003	2004
Cow No's.	24	33	35
Gallons Produced	27,000	37,000	42,000
Gallons Purchased	12,000	10,000	5,000

Financing

Two loans were taken out to purchase cows and to pay for the restructured milk. The milk loan is at a good rate of 3.9% while the cow loan is expensive at 7.8%.

Operations and Management

My main aim at present is to fill my milk quota as cheaply as possible with my limited number of cows.

I milk my herd of 35 cows on the outside farm 4 miles from our main yard, the round trip takes 1-1.5 hours twice a day. I try and keep the system as simple as possible by allocating grass every 24 hors, spreading fertiliser once per week and minimising topping. I still have adequate time each day to participate in the work on the home farm on the dairy herd and beef enterprises with Conor and my father Michael.

The land I am farming consists of both dry and wet land and is located about 450 feet above sea level. I achieved 255 days at grass in 2003 and my target is to reach 280 this year. Grazing starts on February 10th. And is targeted to run until Nov 1st.

The herd is yielding well at 1200 gallons/cow at 3.72% fat and 3.35% protein, but meal feeding is coming in at about 500KGs per cow which is above target. I will have some of my own replacements next year and will review yield lactation length and meal feeding in the light of what quota I will get in 2005.

Costs and Margins

My cost targets on establishment were 7 cent/litre for variable and fixed costs and 14 cent/litre of a net margin i.e. 50% retention of output.

At present variable costs are running at 7.5 c/litre and fixed costs are nearly 8.0 cent/litre due to high rentals and interest payments and production is not high enough to dilute out these costs.

Breeding

I use DIY AI and my breeding goals are to have medium yielding cows with good solids and fertility. Bulls used in 2004 were RMB, RUU, LLO, AHD, IRL, Herd EBI is 24.

The Future

I will continue to look at every opportunity for expansion which will yield a return for my time and management input, eg partnerships, management arrangements, I will stick with black and white cows, whether these will be well selected Holsteins or New Zealand Friesian I am not fully decided.

I will supply Dairygold and hopefully receive quota at a similar rate to the last few years.
I will examine the structures and facilities on the farm to gear it up for a larger herd, which will be needed in future. The use of low cost facilities like earthen bank tanks and reed beds appeal to me as money saved on concrete could be better spent elsewhere.

Summary

I experienced some difficulties along the way in developing this milk production unit, some of which were due to the fragmented nature of our home farm. The twice daily trip to the new milking facility adds 128 miles per week to the clock + all other trips to our outside farms comes to over 350 miles per week. Seasonal tasks such as calving, breeding etc all add up to extra travel and calving in particular at 5 miles from our house can be difficult. Milk price and margin will need to be good to reward my efforts and those of all farmers in the years ahead.

To finish, I would like to thank my parents for partial funding, my brother Conor for the relief milking. Billy Kelleher and Paddy Crowley for their advice as monitor farmers and especially Billy for landing me with the opportunity to tell my story here today.

Expansion through Partnership

Tony, Catherine and Patrick Murtagh, Doon, Virginia, Co.Cavan

Background

Our farm is located at Doon in the Virginia/ Mullagh area of east Cavan, 8 miles from the Meath border. The farm until recently was a mixed dairy and beef farm with some horses. The farm would be considered dry in the most part, by Cavan standards.

My parents were blessed when I was born in 1982. In 1983, milk quotas came into being, so only one year of my life has been outside the control of milk quotas. Our quota in 1983 was 86,400 litres (19,000 gallons).

Fast forwarding to 2000, I finished my year in Ballyhaise College and have since completed the Green Cert. I travelled to New Zealand on the Stephen Cullinane scholarship and spent six months working on the farm of Arthur Bryant in the Waikato. On the way home, I spent three months working on grass-based dairy farms in Ohio and New York State.

After arriving home, I worked in construction as well as farming. In 2002, I worked for a year on a 130-cow, grass-based, low cost farm near Virginia. This experience strengthened my belief that a low-cost New Zealand-type farm would work in the Irish dairy sector.

Our own farm at this time had expanded to 30 hectares owned plus seven hectares rented with a milk quota of 277,300 litres (61,000 gallons). The herd by now was all spring calving. About 90% of the farm had been reseeded and a good network of fencing and roadways was in place. The beef enterprise was gone and we were going to concentrate solely on dairying into the future. The horses remain; Tony has a keen interest and they are 'better than any topper' for keeping grass under control.

Twenty-one years of farming:

	1983	***2000***	***2004***
Physical situation			
Adj Ha	20	29	30
Rented	0	7	7
Stock Details			
Dairy cows	25	38	85
Repl heifers	5	10	19
Drystock	35	45	2
Milk production details			
Quota (litres)	86,374	263,790	475,152
Yield (litres/cow)	3,454	6,941	5,600
Milk fat %	3.61	3.87	3.95
Milk protein %	??	3.47	3.38
Concentrate input (kg / cow)	600	560	300
Date of turnout	1st April	1st March	1st Feb

Setting up a Milk Production Partnership

The question was, would the farm support two household incomes into the future? Dairying appeared to be the way forward, but Tony could only acquire a few thousand gallons of milk quota in any given year. Quota was the most limiting asset, followed by land. With 61,000 gallons, I could not come home long-term to farm full-time. The main problems on the farm in 2002 were access to quota and a lack of housing, with cubicles for only 40 cows. Costs were not high and the farm was efficient at producing milk.

The Milk Production Partnership arrangement for farm families came at the right time for us. The obvious incentive was a big amount of milk quota in one go. We were able to get over 40,000 gallons from Lakeland Co-op. We were lucky to be in this region; many partnerships were set up to draw down just a few thousand gallons of quota. We were also lucky in factors such as age, where Tony was not too old, and in quota size, where we were just under the maximum size allowable.

We found the process slow and unsure. We were fortunate with our solicitor and with Ben Roche of Teagasc who helped it along. It would have been much easier if the Partnership book had been written before we started rather than now, with the job done in our case.

What differences has the partnership made?

The most obvious difference is a lot more quota to fill. We are now at 475,000 litres (104,000 gallons) with 85-90 cows.. Tied in with this is a lot more debt, as Catherine is quick to point out. We borrowed €63,000 to buy quota in 2003. We spent over €10,000 on 15 extra cows in 2003 and €10,000 on ten more cows in 2004. In 2003, we fed a lot of meal in the autumn and managed to fill over 90% of our quota. To date this year, we have supplied 13,000 gallons more milk than this time last year. We will have to match last years milk supply pattern over the winter to fill the quota this year.

We did a good deal of the borrowing for cows on an overdraft. The rate we received was very competitive. The short term nature of our borrowings put extra pressure on us financially. The cost savings that we made this year and the extra milk sales mean that the overdraft to be cleared before Christmas. We borrowed for milk quota on a three-year term loan.

We could have maintained cows at milk yield levels of 6900 lt (1530 gals); that is what we were doing in 2000. A number of factors made me decide instead to reduce milk yields to 5600 litres (1200 gals) per cow and fill the quota with more cows:

1. I do not want to milk cows for twelve months of the year, I want a break
2. I would be feeding a tonne of meal to fill the quota with 69 cows; with 85 cows, I feed 300 kg meal per head. This gives a cost saving of €9500 or €600 per head over the 16 extra cows. It would not cost €600 for me to keep the extra 16 cows.
3. I can milk the cows totally off grass. The plan is that no cow will milk off silage. The limited grazing area at home is used purely to produce milk and when they are dry, cows are kept cheaply elsewhere.
4. This system should give us more flexibility in the future; we are not tying up our money in sheds and concrete.
5. Grass silage is becoming an expensive feed and I wish to move away from it. There are more options to winter cows cheaply over a long winter if lactactions are shorter

We are aiming to fill the quota as cheaply as possible. We put the cows to grass day and night this year as they calved. Calving started at the beginning of February. We feed no meals during the spring and summer and did not start feeding some until the farm cover merited it and we felt a need to push the cows, which was around the 15th of October.

In our breeding programme, we are going for survivability and fertility. We want a cow that is easier to winter, cheaper to feed and is more fertile. It is good to see the EBI following our example. Last year we used Hugo, Kabul and Linde Bartho. We may use Hugo and Kabul and Dano in 2005.

Because of the good grass growing year, it was hard to keep the grass eaten on our farm in 2004, even with the large number of cows, and the level of nitrogen use is well down on other years. Utilisation would appear to have been better than other years. I find that measuring and budgeting grass allows me to see a surplus or deficit of grass several weeks in advance, so I can take remedial action in time.

Our cows calved outside this spring with minimal interference, without any problems. Having the milkers outside eased the workload considerably. Our calves have been on once-a-day yoghurt milk for the last few years. Eliminating the drystock enterprise has helped us focus more on the cows.

I have seen large numbers of cows been farmed across the world. I believe it was very important for me to travel and to see farming outside our own and to know that there can be different methods of working. After working in a different sector of employment, I am surer of my chosen career.

I have the role of day-to-day manager on our farm. It is vital for me that I have responsibility on the farm, instead of being a token partner. If I had not a major responsible role, I would not be at home farming now.

Tony's job is relief milkier, especially on Sunday and often Monday morning. He also keeps me on the straight and narrow. Catherine is by no means a silent partner either. She is the administration boss. She is trying to encourage me to show more than my only occasional interest in that side of things.

At this point, I would like to thank my parents for their faith in me, and for their willingness to let me walk my own path with the farm. I would also like to thank them for letting me be the one to stand up and represent the partnership here today.

Challenges for the future

The most immediate challenges are filling the milk quota and clearing farm debt. These will be solved by next spring.

A more long-term problem area is the milking system. We have an eight unit parlour at present. Depending on the number of cows we will eventually milk, we should be doubling the size of this parlour. The yard is also tight for 100 cows. Should we be spending money in this area? This depends on whether or not we will have access to more land at home, or more quotas?

The ability to winter cows is also an issue. We were short on winter housing even before we went for the partnership. Housing obviously is even more of a challenge today. Another problem linked with this is the limited farm size at home. Even if we had enough shed space, the farm is used now to provide summer grazing for the herd and there is not a lot of spare land for silage making. This winter we acquired wintering facilities on another farm where we will keep the dry cows and in calf heifers. The cows will come home when close to calving. Woodchip pads may have some role in the future, but they haven't been approved yet for general use. Also, they will not solve the winter feed problem. We are looking seriously at the option of renting dry land to grow kale on after a cut of silage for next winter. The cows will graze the kale and eat the round bales of silage. We will be flexible in our approach to wintering over the next few years.

Our grass supply will be tightest in the spring and autumn. This spring, we went full-time to grass too early. In the coming season, calving and turnout are delayed from the beginning of February until the middle of February to ensure better covers until April.

Our aim is to have the cow's diet consisting only of grass. Grass budgeting is a priority on the farm.

Perhaps milk price will warrant a more high cost system in the future; we feel at the moment that this is unlikely. Keeping costs down will always be a challenge. We were efficient before the partnership, we knew what we had to do or spend or not spend. Now with nearly twice as much quota and the problems linked with this, it is harder to know what is happening from year to year. We will have to continue to keep an eye on our profit monitors!

Profit Monitor figures past, present and future

(All figures in cent, litres, and hectares)

	2001	2002	2003	2004 projected
Dairy output c/l	**26.5**	**27.5**	**28.0**	**28.5**
Meal	2.4	2.7	2.6	1.0
Fertiliser	0.9	1.7	1.9	0.5
Vet	1.2	1.5	1.4	1.4
AI	0.5	0.5	0.6	1.7
Contractor	0.8	0.7	0.7	1.1
Other var.costs	0.3	0.6	1.6	1.2
Total var.costs	**6.0**	**7.8**	**8.8**	**6.9**
Gross margin	**20.5**	**19.7**	**19.2**	**21.9**
Machinery	0.4	0.6	1.2	1.0
Car/ESB/phone	1.6	2.0	2.1	2.1
Depreciation	1.2	1.3	2.6	2.5
Other fixed costs	0.8	0.4	1.3	1.3
Total common fixed costs	**4.0**	**4.3**	**8.2**	**6.9**
	10.0	**12.2**	**17.0**	**13.8**
Common costs	**16.4**	**15.3**	**11.0**	**14.7**
Common profit				

The Nitrates Directive will be another concern. Our stocking rate is high. We would be hoping that it would be possible to get some kind of derogation on stocking rate. If we are renting land for winter-feed, this will help reduce our stocking rate. We don't know what the rules will be on the amount of slurry storage required, if we are out wintering stock or using early grazing. When all the issues are known, this topic may have to be revisited.

We would like to continue to expand our quota and land in the future. We will aim to increase our net worth each year. Perhaps land will be more available now in the post-Fischler era. Time will tell.

I wish to acknowledge the role of Macra in my development. The Cullinane scholarship allowed me to travel and see other types of farming in action. In addition, Macra pushed to bring in the partnership scheme, the topic of today's conference. I will conclude by thanking David Colbourne in Teagasc. He taught me in Ballyhaise College and more recently he followed me to Baileborough where he is now my Teagasc adviser and discussion group facilitator.

Better Management through Discussion Groups

Matt Ryan, Teagasc Programme Manager - Dairying

Improved farm profit is achieved through better farm management. In an era of shrinking resources, Teagasc endeavours to provide best management advice to adult farmers by means of farm visits, symposia, short courses, office contact and discussion groups. We now only have 103 Dairy Advisers on the ground. Even though farmer numbers have decreased we are extremely stretched to give unlimited individual contact advice to everyone. Hence the development and need for Discussion Groups.

Teagasc operates 260 Dairy Discussion Groups around Ireland, many through joint programmes with the dairy industry.

WHY DISCUSSION GROUPS?

Why do Teagasc promote Discussion Groups and why should farmers join one? Groups facilitate the efficient use of a farmer's time and of course an Advisers' time. Apart from the preparation time, a three-hour session with fifteen farmers is effectively putting 45 hours of professional work time into those three hours. To understand the benefits of group learning let us look at how a farmer adopts a new practice.

Practice Adoption Involves:

1. Gaining knowledge.
2. Acquiring skills, and
3. Changing our attitude

Farmers will make no changes to their farming systems/practices unless all three are satisfied. Getting the knowledge is the easy part - agricultural information is freely available everywhere. But, changing attitudes is very difficult. Which of our (Teagasc's) communication mediums (symposiums, courses, farm visits etc.) represent the best method of changing attitudes and ensuring faster adoption of new practices - without doubt Discussion Groups are the best. Why ? Because 10-15 farmers sharing technical and financial knowledge about farm practices and systems supplemented by Teagasc, can reassure themselves that a new system or practice is profitable and workable. No farmer who takes on a new practice/system wants to lose money and 'face in his community' - the Discussion Group concept ensures that will not happen.

This is confirmed by many surveys:

- "Discussion Groups act as an evaluative audience for farmers". (Wilke, 1997)
- "Groups tend to check their ideas more thoroughly and make better decisions than individuals". (Tubbs- 1995)
- "My participation in a discussion group has improved my farming practice". So says 95% of group members in a survey by Christie (2002).

WHAT ARE THE BENEFITS OF DISCUSSION GROUPS TO FARMERS?

The main benefits farmers derive from Group membership are: gaining technical information; solving problems; support in trying out new ideas; positive attitude; new friendships; personal development.

Technical Information:

Groups provide farmers with an unique opportunity to get current practical technical information from other farmers who have applied research work and found that it works. They get practical farming ideas, cost saving techniques, technical information on what is best for their own local situation. Farmers value the information coming from farmers and particularly if ‘good’ farmers validate the information given by an adviser.

Meeting monthly ensures the information is current so that problems can be prevented by reminders of what to do. Because of the seasonal nature of farming and the diverse management chores encountered by farmers, this monthly reminder cannot be underestimated.

A recent farmer study (Byrne 1997) suggests that farmers in groups regard the group meeting as their best source of technical information - far ahead of any other source of information. Generally, at any meeting we will have heard 90%-95% of the information before, but it is that 5%-10% new or forgotten information that drives our profit to higher levels.

Solving Problems:

Byrne's 1997 study found that farmers in groups helped each other solve problems. An example of this, is a methodical listing out by farmers of their options in dealing with an over quota problem. Because the suggestions are made, debated and their practicality questioned by farmers, the resulting conclusions are more credible than reading suggestions made in the press.

The confidence and procedure established in solving one problem will, more than likely, be applied to other problem situations.

Support for New Ideas!

Farmers are full of ideas and because of the nature of their job they must be innovative and risk takers. Often at a group meeting, a farmer will say "What do you think of such and such…” He might be told it is a good idea or that it is daft. Many farmers would try new practices if their neighbour was doing the same thing e.g. spreading reduced rates of nitrogen, delaying calving until late February etc. Surprising, the - "What do you think the neighbours would say" ? - attitude still exists in many rural communities.

Be honest, isn't it at the back of all our minds! As about 25% of group members attend groups "to compare their farm with other farms and learn from these farms", farmers derive support from each other.

Generally, before farmers change their farming practices they look for "proof of success" and they get that by meeting and talking to farmers in discussion groups.

Positive!

As the whole group discussion is positive, over 38% of farmers attend the meeting "to meet other positive farmers" (Byrne 1997). Compare this to the negative vibes - "this tax is getting me down", "you'd be better off letting your farm" etc - that predominate in the pub, outside the Church, or at the Mart. Meeting farmers who see a way out of problem situations is stimulating and encouraging.

Friends:

It is fairly hard to make new friends! Nowadays with dairy farmers becoming scarce in the neighbourhood, new friends need to be made to overcome rural isolation (loneliness!). Because of compatibility of interests discussion groups inevitably lead to new social friends. Many groups have a social aspect to their group.

Personal Development:

Many non-farmers attend courses to improve their 'assertiveness' and for 'personal development' reasons - whatever that means! From my experience of seeing farmers, particularly young men, develop and get confidence to speak out, I have no doubt but that discussion groups are a cheap way of achieving personal development. Long term, farming organisations, Co-ops and the industry as a whole will benefit from this.

What have groups achieved?

Discussion Groups are effectively a group of farmers working as a TEAM to improve their income as well as their lifestyle. Success is what drives TEAMS. So it is important to measure the benefits accruing from membership of your Group. Advisers and farmers have told me groups have achieved the following:

- *"Group cow numbers have increased by 89% over the last 12 years".*
- *"Group protein has increased from 3.13% to 3.38% over 10 years.*
- *"Common costs have decreased from 13.80 cents per litre to 10.84 cents per litre during the last 8 years - a 26% reduction even though inflation increased by over 30%".*
- "Common profit increased from 16.8 cents per litre to 17.68 cents per litre during 8 years - even though milk price decreased".

WHAT ARE GROUPS DOING TO KEEP THEMSELVES VIBRANT?

A Discussion Group is like a MARRIAGE. To keep a marriage 'going' it is suggested we have to work at it. I am told the following works, - occasional meal out, night at a concert, box of Roses, flowers surprises etc. plus the 'basics'.

Similarly, groups must be 'worked at' and encouraged to develop so that they continue to make significant contributions to farmers' lives.

Group Goals/Objectives:

The Group members should sit down and debate and decide on the goals and objectives for their group. Write them down and all agree on them. This will help to focus the group on where it is going, what it wants to achieve and enable it to monitor progress over time. Does the Group need rules or procedures? Decide.

Social Outings:

The value of social outings cannot be overstated. The cup of tea during or after a group meeting; going away on a day trip; a Christmas party for wives/partners with members; a few days away in Ireland or overseas to see good farmers; golf outing; celebrating birthdays/group anniversaries etc.

Projects:

Over the last few years Teagasc has introduced the concept of PROJECTS as a means of improving management and management decisions on discussion group members' farms. The projects undertaken were:

- "To improve Johns' farm profit by €10,000 this year". (This is the most important one)
- "To improve Pat's protein from 3.30% in 2004 to 3.35% in 2005".
- "To improve my herd fertility: (a) improve conception to 1st service from 51% to 61% (b) reduce empty cows from 20% to 11% within a 13 week breeding season (c) to reduce herd calving interval from 376 days to 366 days.
- "I will increase herd EBI from 30 at present to 70+ in 6 years time".
- "To achieve target weight gains for my replacement heifers".
- "To reduce my mastitis and SCC levels from ………… to …………".
- "To do and monitor a Grass Budget for my farm for the coming year beginning on the 1st September, 2004".
- "Each group member do a Dairy Profit Monitor, having it completed by 20th January, 2005".
- "Each group member participate in ongoing financial recording through the use of the Cost Control Planner or similar commercial programmes".
- "I will improve my summer grassland management so as to minimise the decrease in milk from one month to the next to 9%".

- "All members to report grassland management details to each meeting as per 'Grass Watch' (IFJ) procedure".
- "I will do monitor and achieve Body Condition Scores, as per Moorepark recommendations, throughout the year".
- "I will reduce my weekly work time by 4 hours".
- "To undertake the 'New Nitrogen Application rates' for my stocking rate".
- "To estimate the financial losses due to Herd Health issues, (Mastitis, Lameness, Milk Fever, retained placenta, calf deaths, vulva discharge).
- "The group will use ICBF herd health data for the whole group to explain Profit Monitor financial differences".
- "A group member to act as Safety Officer and report on the safety features of the farm being visited".

Procedure for Dealing with Projects:

Once a member decides to take on a project (only one group member should be reporting on a project even though more could do it), he must be totally committed to achieving the target. He must assemble all the relevant historic data. The group will either visit his farm or make suggestions at an indoor meeting visa-vis his targets and plan of action for the year.

At each meeting during the year he will have to report briefly (5-10 minutes) on progress and seek advice on what he should do to improve matters over the next month. He will submit an end of year summary on achievement, financial benefit and difficulties encountered.

The project to increase a members profit by €10,000 is the most exciting and challenging and embraces all aspects of farm management.

WHOLE FARM ANALYSIS:

Because of the pool of expertise within a group, it is a wasted opportunity not to use the group to analyse each member's management performance, that is, overall farm profit. Use the Teagasc Dairy Profit Monitor. Divide the group up into 3 or 4 subgroups, who, independently, would examine all the costs, sales etc. and management efficiencies. Near the end of the meeting bring all subgroups together and write all the suggestions on a flip chart and discuss. The facilitator should write up the conclusions, which should be monitored over time.

FARM INVESTMENT APPRAISAL:

Any major investment being made by a group member should be the focus of a group meeting. Could anything be better than getting the opinion of 10-15 'experts' as to the size, type, site for a new milking parlour or whatever investment is being made. The host farmer, having got the suggestions, can make up his/her own mind.

WORKSHEETS:

These involve, having the group members answer 6-7 relevant questions, in advance of the meeting and either bring the data to the group or have it filled by a member in advance. This latter suggestion speeds up the process. Worksheets are a very good idea to keep the group informed about its' members management and problems.

FURTHER EDUCATIONAL COURSES:

Former USA President, Bill Clinton, said, "you will earn what you learn". Therefore, the Group should continue its' educational advancement by organising short courses in for example; financial management, bookkeeping, stress management, personal health care; personal exercise; communication; time management etc.

FEATURES OF A GOOD DISCUSSION GROUP:

1. **Owned by members who will:**
   - Delegate and organise tasks/outings.

- Choose topics/members.
- Notify members.
- Have a good facilitator.
- Organise events/outings
- Organise speaker etc.
- Know each others phone numbers, emails.

2. Have an AGM:

- Elect Chairman (1-2 years) and/or Treasurer.
- Set out goals/targets for the group.
- Review previous years work.
- Annual programme for the coming year.

3. Have Social Outings:

- Visit other farms/interesting venues.
- Christmas Party.
- 2-3 group members do all the planning.

4. Group Meeting:

- At least once per month and more often if a necessity arises.
- Set time and date each month - essential.
- Duration: 2½ hours.
- Format: Farm + tea + night meeting.
  Farm + lunch pack + chat.
  Farm only (a.m. or p.m.)
- Start/Finish on time.

5. Expectations of Members:

- Maintain group confidentiality.
- Come on time, notify chairman if you cannot attend.
- Wet gear (clean), notebook and biro, calculator.
- An open mind.
- Be active not passive.
- No chatting in sub-groups.
- Disinfect coming and going from farm.

6. **Use 'Guests' Carefully**:

- A good group session will have farmers talking 70% of the time.
- 'Guest' speakers can interfere with this balance.
- Eventually the group will run out of guest speakers and the group will not survive.

7. **Chairman's Role:**

- Introduces the session; people, objectives etc.
- Announces next farm venue.
- Closes meeting.
- Reviews/analyses the session with the host farmer and Adviser.
- Makes new/shy members comfortable.
- Drives the group for his term of office, maybe with consultative support from a few group friends.

YOUNG FARMERS GROUP:

As the next generation of farmers will come from the present 17-25 year olds, it is important that these budding entrepreneurs be involved in farming decisions and activities. It is absolutely essential that these young men/women are involved with their farming peers to make friends, to support each other and to learn and apply new farming practices. This is best done in a Specific Young Farmer Discussion Group. Teagasc will help in their formation and facilitation. They exist in some areas at present.

RETIRED FARMERS GROUP:

Such a group exists - driven, facilitated by themselves to their own agenda with a very interesting and appropriate agenda. This, again, confirms the need for Discussion Groups and our need to talk and discuss issues with other like-minded people.

TEAGASC'S COMMITMENT:

Teagasc is very committed to the concept of Discussion Groups. We have special facilitation training courses for our staff. Each month we have updating on technical matters as well as facilitation updates. Advisers have a back up service from Specialists and Researchers so as to make objective information and research data available to farmers in groups. Anyone with a few farmer friends who wishes to set up a new group, feel free to talk to us.

SUMMARY:

A well run discussion group will put €000's on to its members' profit each year as well as improving members' personal development and friendship base. Members must work at keeping the group vibrant. Projects, social outings, planning and evaluating group progress will keep a group successful.

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The Positive Horizon Discussion Group

Dan Lynch, Watergrasshill, Co. Cork

To promote the business and personal development of the members, to develop farming systems that allow total sustainability, increased profits and an enhanced quality of life. (Mission Statement)

Membership

Our group was formed in 1996 as part of the Teagasc/Glanbia Joint Programme. We have 19 members from 5 parishes most of whom have been with the group from the beginning. All are involved in spring milk production with cow numbers ranging from 24 to 104. Farm size varies from 18.2ha to 78.5ha. Most of the group have a cattle enterprise. Three members are currently in REPS.

As a group we struggled early on with the concept of discussion groups. Attendance varied, participation and discussion was poor. We depended heavily on our Teagasc advisor or facilitator to keep the meeting going. Eventually we elected a chairman who met with our Teagasc advisor and drew up a yearly plan for the group. This included farms to be visited, facilitators and a definite meeting date each month. A list of names, addresses and telephone numbers was issued to all members. Most importantly a date was fixed for the A.G.M.

This allowed us to plan according to members requests and also to implement some simple rules.

1. Anybody unable to attend a meeting must notify the chairman.
2. If you miss three meetings and do not notify the chairman you will not be notified in advance of the next meeting.
3. All members must do the Teagasc Profit Monitor and submit it by the end of January.

4. An annual fee was agreed for the creation of a group fund
5. The second Wednesday of every month was chosen as our meeting date.

A few members of the group travelled out to meet other groups in the hope of gaining new ideas. A special meeting was held afterwards to discuss and implement some of these. A flip chart was purchased and results from worksheets issued in advance of the meetings were recorded by the chairman. Each member had to ring the chairman prior to the meeting in connection with the worksheet. This allowed the chairman to open the meeting and give a summary of current events before handing over to the facilitator. Time is allowed for a group member who is on the Glanbia advisory committee to update the group on co-op matters. All on farm meetings aim to improve the lot of the host farmer. Other events were also organised, such as a day trip away to visit other farms and a social event where wives and partners could attend was also planned.

From this interactivity the group decided to hold a communications course. The aim was to improve our personal skills and in turn improve our meetings. After considerable debate the group was named the Positive Horizon Discussion Group. The development of a strategic plan followed. As outlined in our mission statement it gave us the objectives of increased profits and cost efficiency along with increased personal development and quality of life.

While some members were sceptical at the time, the benefits of the course have been of immense value. Attendance is no longer an issue. Members now feel more comfortable discussing issues that affect them. This was highlighted in the very wet June of 2002 when farming was experiencing exceptional difficulties. Two special meetings were held over a period of two weeks at members' requests. There was a full attendance at both meetings. All members concerns were discussed fully.

Projects

The introduction of projects has also helped improve the group. We started with a financial project. The aim was to improve one member's profits by €10,000 per year. The Teagasc Profit Monitor and Cash Flow Budgeting Program were used. The group visited the farm in early January to review the budget and plan for the forthcoming year. The members divided into a few groups and each group focused on different aspects of the plan. The final plan was then drawn up in agreement with the host and his wife. If the target was achieved they promised to buy a drink for all members at our annual social event. At each monthly meeting the project was referred to briefly and the progress to date outlined. This farm was visited in

June and again in September to monitor and evaluate this project. The profit monitor was completed and the final outcome was discussed the following January. The target was €10,000 and €9,000 was achieved. This came about through increased cost efficiency and extra cattle purchases. That member and his wife felt this would not have been possible without the support of the group. As promised they bought us all that drink!!

Based on this success we continued with the financial project. The following new projects were also taken on, Grass Budgeting, Fertility and Protein. One member volunteered for each project. "Helpers" were assigned to assist with each project throughout the year. A plan was drawn up in advance, with targets assigned to each project. Each farm involved in a project was visited twice during the year. The grass budgeting project required a grass cover to be done every two weeks. One of the members was very good at this and took time to show the host member until be became familiar. When reassurance was needed at various times he was on hand to help out. Due to an earlier turn out date and maximizing grass allocation through out the year, the project was worth €2,700 to this member.

Likewise with the fertility project a few members helped condition score the herd involved in the project. This was done pre-calving and before the breeding season started. The choice of bulls being used was discussed and a list of four to be used was drawn up. From previous years records our advisor was able to highlight weakness and any necessary action was planned for the year. The end of the year it was calculated to have been worth € 10,223 to this member, due to more compact calving.

The protein project was similar to the grassland project as better use of grass helped increase protein for the member. Some culling of low protein cows also improved the position. An increase in herd average from 3.33 to 3.40 was achieved. This was worth €750 to this member.

Another financial project was undertaken and again the aim was to improve profit by €10,000 per year. In this case bull beef was considered an option (something not previously done on the farm). It looked a risky option but after discussion the host farmer was reassured and went for it. With extra cost control, €8,000 extra was achieved over and above the previous year.

All of the above projects and a few more minor projects are in progress at the moment. While everyone involved in a project has more of a focus all group members learn from every project. One exercise puts a value on all these projects. That is the Teagasc Profit Monitor.

Profit Monitor Role

We are very fortunate to have a monitor farm farmer in our group. This sold the concept of the profit monitor to us very quickly. Anxious to compare ourselves individually with the figures from this farm has placed the profit monitor at the core of the group. A special meeting is held each February where each member's figure are discussed by the group. This has been further enhanced by eight members completing the Cost Control Planner and Dairy Herd Monitor. Just as the Profit Monitor is completed by all members the same will happen in relation to these. Common costs have remained static for the group in the last three years at 12.5 cent per litre. Taking inflation and falling outputs (mainly due to drop in milk price) into account the situation could have been worse only that we were able to monitor evaluate and adapt our business accordingly. This has made the Profit Monitor an invaluable tool for our group.

The Future

Going forward as a group we need to continue to adopt new concepts and ideas in order to keep the group dynamic. The group has taken short courses on communication and financial management. REPS and partnerships will be looked at in more detail. We will also participate in a course on time/stress management this winter to further our personal development.

Finally as a group we are indebted to our monitor farmer, Cathy and Tom Kearney. Their openness with facts and figures and encouragement can never be underestimated. We would also like to acknowledge all the assistance we have received from Teagasc personnel, various specialists and other discussion groups. Special mention must go to our Teagasc advisor Donal Murphy for all his help. Also to Matt Ryan and Tom O'Dwyer who we have bothered more than most.

I would also like to thank all the members of my group for allowing me tell our story. We are ordinary individuals in an unusually named group who have become great friends while trying to be better farmers

Nutrient Efficiency on Farms

J. Humphreys, K. O'Connell, A. Lawless, K. McNamara & A. Boland
Teagasc, Moorepark, Solohead & Johnstown Castle

Introduction

Compliance with legislation regulating nutrient (mainly nitrate and phosphorus) losses is an increasing constraint on agricultural production in Ireland. Cross-compliance and the implementation of the National Action Programme under the Nitrates Directive are placing increasing requirements for improved nutrient management on farms and are matters of increasing concern for farmers. Changes to agricultural supports following the recent reform of the common agricultural policy (CAP), such as the projected fall in milk price create the need for lowering costs on farms. Increasing efficiency of nutrient use on farms is beneficial from an environmental perspective. It can also result in considerable savings in fertilizer and other costs at farm level. These savings can arise in indirect ways. For example, lower fertilizer nitrogen (N) use during the second half of the grazing season can avoid the need to harvest surplus pasture as baled silage. The saving in fertilizer N is small compared to the saving of making less bales. Keeping soil potassium (K) in line with recommended levels can lower the risk of grass tetany (hypomagnesaemia) and lower the amount of docks in grassland. High availability of K in soils promotes the high uptake of K by the pasture, which hinders the uptake of magnesium leading to tetany. Also, docks need higher soil K levels than grass. Keeping soil K levels are in line with pasture requirements helps to keep docks out of the sward. With high soil K levels, docks are able to dominate the sward.

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. Improvements can be made by closely matching fertilizer inputs to stocking rates. Close attention is needed to avoid losses during the spring and autumn. This can be achieved during the spring by applying fertilizer at rates and at times that anticipate the increasing demand by the sward. Slurry can also be used to effectively replace purchased artificial fertilizers. During the autumn it is necessary to apply the last application of the season early enough to ensure that there is sufficient time remaining in the growing season for most of the fertilizer to be taken up by the sward. This generally means applying fertilizer N before mid-September. High rates of loss can be expected with later applications because of the very high levels of rainfall that can be expected during the winter. Rhizobium bacteria in association with white clover have the potential to supply up to 140 kg N/ha/year. The wider adoption of white clover in Irish grassland has immense potential to lower the requirement for fertilizer N. This paper focuses on increasing nutrient-use efficiency while lowering costs in grassland-based dairy production in Ireland.

Fertilizer N use on Intensive dairy farms

Surveys of fertilizer N use on intensive dairy farms indicate that there is considerable variation in quantities of fertilizer N used on farms with similar stocking rates (Fig. 1). There are a number of reasons for this including differences in soil-type and natural background fertility (see below). There are also differences in the type of stock being carried and in the extent to which maize and whole-crop are grown on farms and the extent to which concentrates and other feeds are imported onto farms. These latter aspects will tend to lower fertilizer N use on farms. Nevertheless it is also clear that some farmers are using N more efficiently on their farms compared to others. It can be seen in Fig. 1 that fertilizer N use on farms stocked at 2.5 LSU/ha ranges between around 225 and 400 kg/ha. This raises the question of why one farmer is able to get away with using much less fertilizer N than the other?

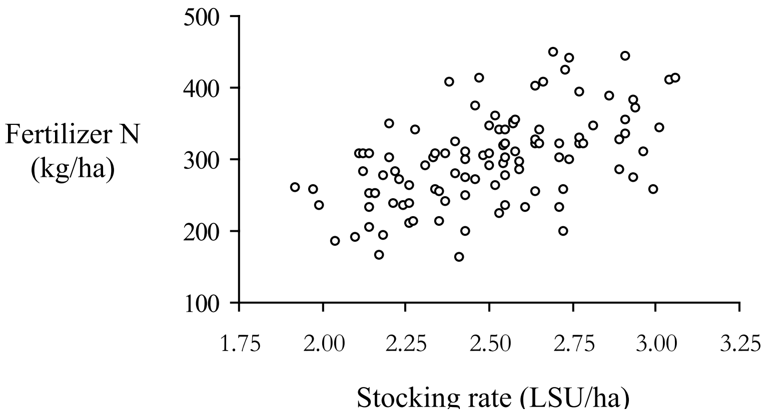

Figure 1. Fertilizer N use on intensive dairy farmers in the south west of Ireland.

Factors influencing losses of nutrients from the soil

Available N for uptake by the sward

Efficient management of N on farms requires that N is supplied to the soil at a time and in a manner that ensures that as much of that N as possible is taken up by the sward and used to grow grass to feed livestock. This requires that losses between application to the soil and uptake by the sward are minimised. A certain amount of knowledge of the factors that can cause losses of N from the soil is therefore useful.

Nitrogen is available in the soil to plant roots in two forms: nitrate and ammonium. Both of these can be taken up and used by the sward; it makes little difference to the sward. Fertilizers supply both nitrate and ammonium, for example, CAN is calcium ammonium nitrate. Urea, on the other hand, is broken down to ammonium once it is applied to the soil. Any ammonium that is not readily taken up by the grass roots accumulates in the soil where it is converted to nitrate. This is unfortunate because nitrate is very prone to being lost from the soil.

Soil particles are negatively charged. Ammonium in the soil is positively charged and therefore ammonium is held quite well in the soil. In contrast, nitrate is negatively charged and therefore is not held very well in the soil (it is repelled from soil particles in the same ways as similarly charged magnets repel each other). Therefore nitrate in the soil moves very easily with movements of the soil water. This facilitates transport of nitrate to the plant roots when soil water is being taken up by the sward. The soil water is drawn to the plant roots by a process called evapotranspiration. Evapotranspiration is the combined effects of evaporation and transpiration, which draws water out of the soil and up into the grass-sward. Around 450 mm of water is drawn out of the ground by evapotranspiration each year and goes off into the atmosphere as water vapour. This is the equivalent of 4,500 cubic metres of water per hectare each year (a little less than 400,000 gals/acre).

Nitrate leaching and denitrification

The mobility of nitrate is a disadvantage under conditions of high rainfall because it leads to leaching. This is a mechanism by which nitrate is washed out of the topsoil as the water passes down through the soil profile. Leaching of nitrate is mostly associated with sandy free-draining soils where surplus rainfall is readily washed down through the soil profile. In heavy soils with impeded drainage, nitrate is lost by a different mechanism that is also dependant on the soil water status. Under high rainfall the soil pores of heavier soils get increasingly saturated with water. This drives oxygen out of the soil. Under such circumstances certain bacteria in the soil are able to take the nitrate (NO_3) and detach the oxygen (O_2) and use it to survive the waterlogged conditions. This process is called denitrification and leads to the release of N_2O and N_2 gasses into the atmosphere. Denitrification is by far the most important mechanism for loss of N from Irish farms.

Therefore leaching of nitrate and denitrification of nitrate are caused by wet soil conditions usually due to high levels of rainfall. In Ireland, there are high rates of rainfall during the autumn, winter and spring (Fig. 2). In contrast, there are highest rates of evapotranspiration during the late spring, summer and early autumn (Fig. 2). Average rainfall in Ireland is around 1000 mm per year, whereas evapotranspiration is around 450 mm per year. The difference is known as surplus rainfall, which either drains down through the soil or runs off the soil surface into drains etc. This surplus rainfall amounts to around 550 mm per year (5,500 cubic metres of water per hectare or around 500,000 gals/acre).

It can be seen in Fig. 2(b) that most of this surplus rainfall occurs between October and January. These huge volumes of surplus rainfall can cause considerable losses of nutrients either by denitrification of nitrate, nitrate leaching and losses of P and K from the soil. This has implications for the timing of application of fertilisers and slurry.

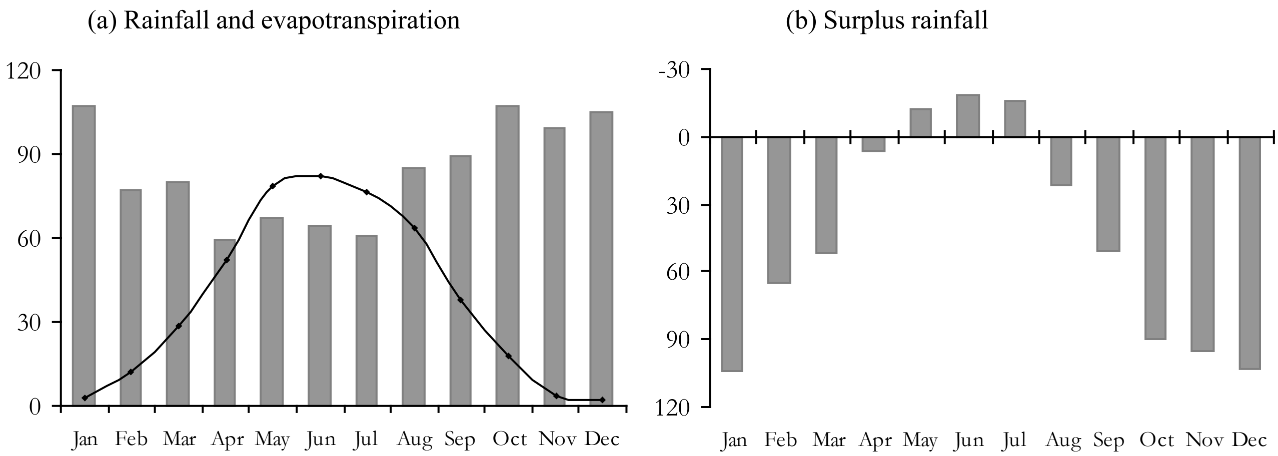

Figure 2. (a) Average monthly rainfall (bars) and potential evapotranspiration (lines) (mm/month) and (b) Surplus rainfall (mm/month)

Volatilisation of Ammonia

These opposing effects of rainfall and evapotranspiration also influence the other important mechanism of N loss from grassland, which is the volatilisation of ammonium (NH_4) to ammonia (NH_3) gas. This loss of N is generally associated with the application of urea fertilizer. Once urea is applied to the soil, it is broken down into ammonium dissolved in the soil water. Ideally this soil water seeps down to the grass roots. However, under good drying conditions, the water containing the ammonium can be evaporated off into the air as water vapour. The ammonium dissolved in this water is like-wise volatilised off as ammonia gas. It can be seen in Fig. 2(b) that evapotranspiration exceeds rainfall during May, June and July. Hence, these are the months when there is greatest risk of volatilisation. Generally speaking, it is not recommended that urea fertilizer be used after the beginning of May for this reason.

While volatilisation is mostly associated with urea fertilizer in many people's minds, the greatest losses of N by volatilisation occur during the application of slurry. The N in slurry is in two main forms: (1) ammonium and (2) organic material, which is the solid fraction of the slurry, such as the fibrous residue of digested silage etc. Ammonium accounts for around 50% of the N in slurry and the solid fraction accounts for the other 50%. Once the slurry is applied the ammonium is immediately available for uptake by the sward. The N in the solid material only becomes available as the organic material rots away over time.

However, the ammonium in slurry can easily be lost by volatilisation in the same way as it is lost following the application of urea fertilizer. In fact, virtually all of the ammonium in slurry applied between May and August can be lost by volatilisation, particularly where slurry is applied to bare silage stubble under dry conditions during the summer. This is partly because of the weather conditions but it is also due to the method of application. The application by splash-plate where the slurry is sprayed into the air promotes the process of volatilisation. These losses occur during and immediately after application and virtually all of the ammonium in the slurry can be lost within a few hours of the slurry being applied. This loss mechanism occurs very quickly and results in large losses of N. The application of 33 cubic metres/ha (3000 gals/acre) of slurry can contain around 100 kg N/ha, half of which is ammonium dissolved in the liquid fraction. Hence, around 50 kg N/ha is rapidly lost by volatilisation when the slurry is applied under the wrong conditions. This is a lot of N when it is considered that average fertilizer use by the group of intensive dairy farms presented in Fig. 1 is 300 kg fertilizer N/ha. In other words the above 50 kg ammonium-N in slurry represents one-sixth of fertilizer N use on these farms. This indicates one area where there is scope to improve efficiency.

Volatilisation losses can be minimised by applying slurry under conditions that promote the rapid infiltration of the slurry into the soil. Two factors facilitate the achievement of this objective (1) applying slurry under damp misty conditions and (2) applying fairly dilute slurry.

Damp conditions

To get best response to slurry, it is necessary to apply slurry under cool damp misty conditions and that these conditions precede or coincide with active grass growth and rapid uptake of nutrients from the soil. The most ideal concurrence of these conditions is during the spring during the months of February, March and April. These conditions coincide also during September and October. However, when slurry is applied in October, this slurry is being applied just prior to the four wettest months of the year (Fig. 2a) and at a time of declining grass growth during which the uptake of nutrients is also in decline. Hence, while applying slurry in October might lower ammonia losses, the risk of losses of P in runoff and of losses of nitrate by denitrification and leaching over the winter is substantially higher. Hence, for autumn applications of slurry, it is best that slurry is applied during late August and September.

Greatest responses can be achieved with slurry applied during the spring. This is because the slurry is being applied at a time that promotes the infiltration of the slurry into the soil. There is also a huge increase in grass growth going from around 5 kg DM/ha/day in January to around 80 kg DM/ha/day by the end of April. This generates a huge demand for the nutrients ensuring rapid uptake and efficient utilization of the nutrients in the slurry. Furthermore, it was pointed out above that around half of the N (and a substantial proportion of the P) in slurry is contained in the solid material. When slurry is applied during the spring, the solid material gets washed down into the soil where it rots away slowly during the summer months. Therefore the nutrients released by the rotting of the solid material are available for uptake by the sward during the summer months. In contrast, when slurry is applied during October, the solid fraction rots away during the winter months, when uptake by the sward is low and there is high rainfall causing the loss of these newly released nutrients by run-off, denitrification or leaching. Therefore, the spring is the best time to apply slurry followed by the early autumn (late August and September).

Application of Dilute Slurry

The solid fraction or DM of slurry in Ireland generally accounts for between 2% and 10% of the total volume of slurry. As slurry becomes more dilute due to rainwater or mixture with dirty water, this causes a dilution of the nutrients contained in the slurry. It also creates greater volumes of slurry that need to be managed.

One surprising aspect of the efficiency of utilization of N in slurry is that as slurry gets more dilute, the relative efficiency of utilization of the ammonium-N increases. This is because more dilute slurry infiltrates into the soil much more quickly that higher DM slurry. With high DM slurry, the slurry is more likely to adhere to grass where it remains exposed to the air. This exposure leads to volatilisation. The dilute slurry dribbles down into the soil. The ammonium adheres to soil particles where it is available for uptake by the grass roots.

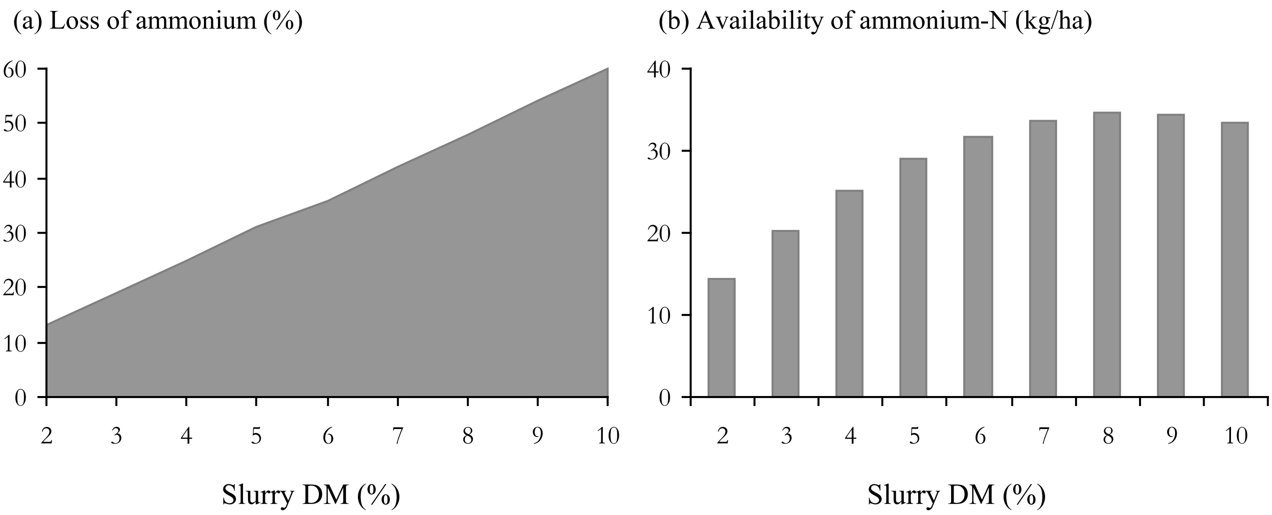

Figure 3. The effect of slurry dry matter content on (a) loss of ammonium following application expressed as a percentage of the ammonium present in the slurry prior to application (*from *Pain, 2000) and (b) availability (kg/ha) of ammonium-N in the soil for plant uptake following application of 33 cubic metres slurry/ha (3000 gals/acre).

In Fig. 3(a) it can be seen that as the DM content of the slurry increases, the proportion of the ammonium-N that is likely to be lost also increases. In other words, as slurry becomes more dilute, the ammonium-N in the slurry becomes less concentrated, but as it does, the ammonium-N is less likely to be lost by volatilisation following application. The net effect is that as the DM of the slurry decreases from 10% to 6% the availability of the ammonium-N for uptake by the sward remains more-or-less the same in terms of kg N/ha for the same volume of slurry applied (Fig. 3b). With more dilute slurry (less than 6%DM) the availability of ammonium-N decreases but not at a rate directly proportional to the extent of dilution.

Increasing the dilution of slurry increases the volume of slurry that needs to be handled and this is a disadvantage. On the other hand, making the slurry more dilute increases the efficiency of N utilization. This is particularly the case for slurry applied during the summer months when the likelihood of volatilisation is greatest. Hence, greater dilution may not necessarily be wholly disadvantageous. Furthermore, dilute slurry is a fact of life on many farms where slurry is stored in out-door tanks and where dirty water and slurry are stored and handled together as one material.

Grass growth and nutrient uptake from the soil

High efficiency of nutrient-use on a grassland farm requires the efficient transfer of the nutrients available in the soil into the grass sward. The longer that nutrients are available in the soil and not taken up by the sward the longer they are at risk of being lost. The efficiency of transfer of available nutrients from the soil into the grass sward depends to a large degree on the rate of grass growth. For example, during good grass-growing conditions the sward takes up large amounts of available soil nutrients each day. During conditions of poor growth during the winter or during drought conditions, the uptake of nutrients can be virtually zero. Therefore grass growth, and the factors that influence grass growth, have a major bearing on the efficiency of nutrient-use on grassland farms.

Factors influencing grass growth

Sunlight (day length and intensity), soil temperature and soil moisture are the three primary determinants of grass growth. Sunlight provides the energy that fuels grass growth through the process of photosynthesis. The extent of Sunlight depends on the combination of day length and the intensity of the sunlight (Fig. 4a). Day length varies from around 8 hours/day in mid-winter and 16 hours/day in mid-summer. However, as can be seen from Fig. 4(a), the incidence of sunlight is about 10-times higher in mid-summer than in mid-winter. This is because the intensity of sunlight is about 5-times higher in mid-summer than in mid-winter. This is fairly obvious when you think about it; the risk of sunburn is much higher in summer than in winter.

During the winter and early spring low soil temperatures limit grass growth. At soil temperatures of less than 4.5°C there is no net accumulation of new pasture. Between 4.5°C and 6.0°C there are small amounts of pasture accumulation. It is only when soil temperatures increase above 6.0°C that there are substantial amounts of grass growth. Grass growth increases rapidly with increasing soil temperatures above 6.0°C. It can be seen if Fig. 4(d) that there is considerable variation in soil temperatures between Valentia in the Southwest and Clones in the Northeast. Grass growth continues virtually all the year round at Valentia but is limited by low soil temperatures during December, January and February at Clones.

Soil temperatures are often considered to delimit the length of the grass-growing season. However, sunlight has a much greater influence on the extent of the grass-growing season in Ireland, as can be seen by comparing Fig. 4(a) and Fig. 4(c). This is hardly surprising taking into account that sunlight is the fuel that drives grass growth. The most conspicuous difference between sunlight and grass growth is the peak of grass growth that occurs during May that is not reciprocated in the incidence of sunlight. This peak of grass growth is generated by changes in the internal physiology of the grass sward. During April many of the tillers in a grass sward become reproductive; i.e. they begin gearing themselves up to start producing seeds. These tillers shut off translocation of nutrients to the roots, production of daughter-tillers etc. and concentrate translocation of all available nutrients towards seed-head production, which causes the peak of DM production during late May. This can generally be observed as the sward becoming stemmy during May. Once these reproductive tillers are killed off by grazing or topping, they are replaced by vegetative tillers leading to an increasingly leafy sward from mid-summer onwards. These vegetative tillers are not as highly productive as the reproductive tillers. During the second half of the year the sward is focused on producing new daughter-tillers and on the accumulation of a reserve of sugars in the stubble that is used to sustain the grass over the winter months and to fuel initial growth during the following spring.

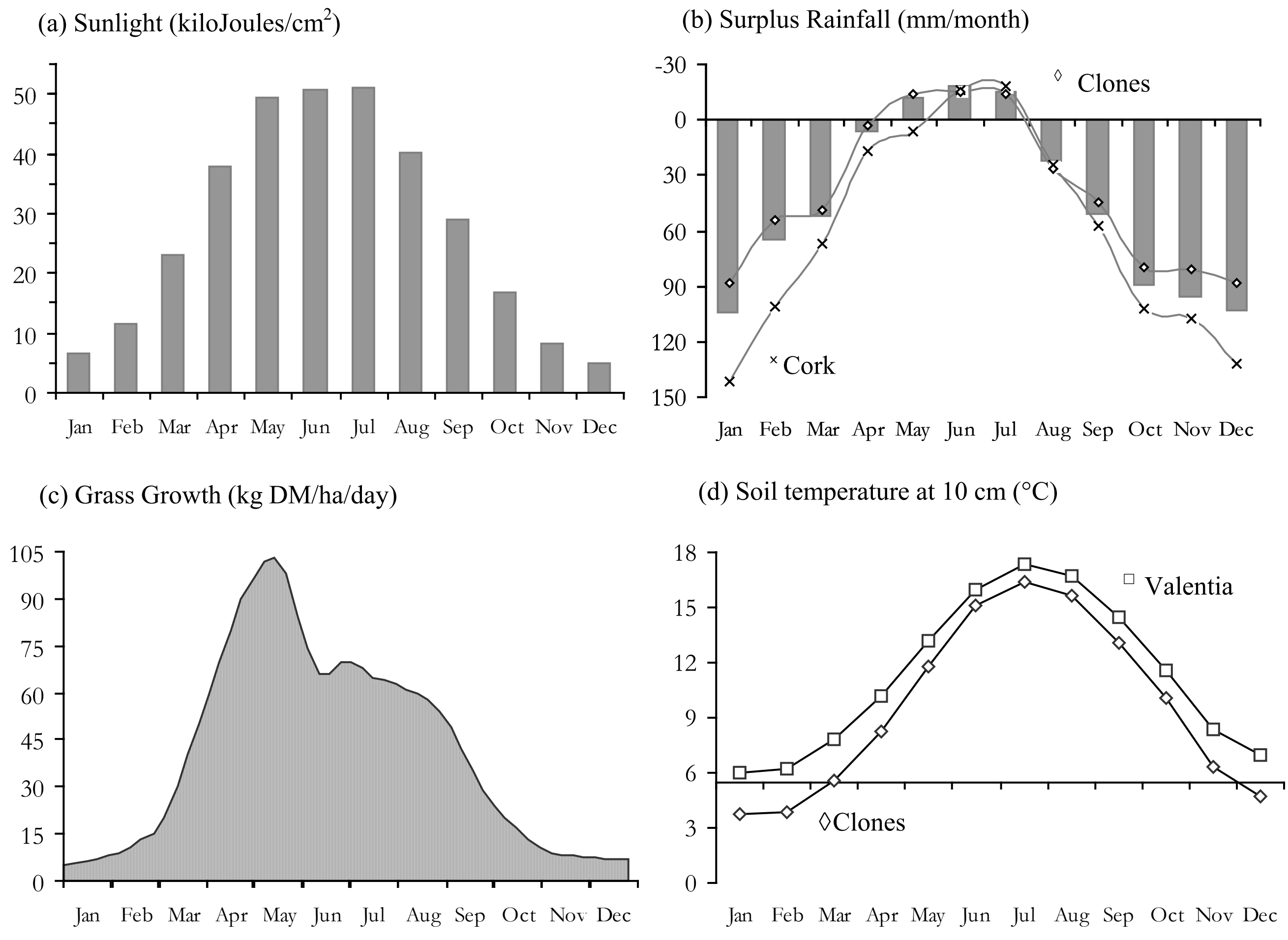

Figure 4. Global solar radiation, surplus rainfall, grass growth and soil temperatures during the year

When soil temperatures (Fig. 4d) are compared to grass growth (Fig. 4c) it can be seen that while grass growth increases very rapidly during March and April to reach the peak in late May, soil temperatures are much slower to increase during this period. This is because soil temperatures are influenced by sunlight. During the winter the soil cools down as day length and sunlight intensity decline. From mid-winter onwards, days get progressively longer and sunlight increases in intensity. However, it takes a while for the soil to heat up and therefore there is a lag between the incidence of the sunlight (Fig. 4a) and the consequent increase in soil temperature (Fig. 4d). Whereas highest sunlight occurs during May, June and July, highest soil temperatures do not occur until June, July and August because of this lag. On the other hand, as the incidence of sunlight declines from mid-summer onwards, soil temperatures are much slower to cool down. While lowest sunlight coincides with the shortest days in late December, lowest soil temperatures are recorded during January and February. Early February is often the coldest time of the year.

This has clear implications for grass growth. Soil temperatures generally place a greater constraint on grass growth during the spring than during the autumn. During the autumn grass growth is constrained more by decreasing sunlight and by changes in the physiology of the sward. During the late autumn the sward begins to accumulate resources in the stubble rather than producing new leaves that might be burned off by frost. Also, the grass leaves are the machinery that absorbs sunlight for photosynthesis. The cost of running this machinery is respiration, which describes the energy used to maintain the internal workings of the grass sward. As sunlight declines during the autumn the respiration cost associated with a large amount of leaf material can begin to exceed the level of photosynthesis that can be generated using the declining sunlight. Hence, having a large amount of leaf material starts to become a liability. Under such circumstances there can be net respiration where the sward is burning more energy than is being absorbed from sunlight. Under such circumstances the grass starts to shed some of its leaf material, which is often manifested as white-tips on the leaves of grass. In the past, the white tips on heavy covers of grass during the late autumn have occasionally been attributed to N deficiency. This is an erroneous assumption. This process can also lead to a loss of DM when heavy covers are carried into the winter.

It has been pointed out above that a soil temperature of 6.0°C is seen as an important threshold for grass growth during the spring. It has occasionally been suggested that, because soil temperatures remain above 6.0°C until as late as November, this justifies the application of fertilizer N during November. This is pure nonsense. Applying fertilizer N during November is a complete waste of money. The possibility of getting any worthwhile response in grass growth to fertilizer N is long gone by November. Furthermore, as can be seen from Fig. 4(b), high rates of surplus rainfall will be entering the soil during November, December and January during a period when uptake by the sward will be virtually zero. Fertilizer N will not remain for long in the soil under such conditions.

Generally speaking, soil temperatures during the winter and spring are relatively high in coastal areas in the south and west compared with inland areas of the north and east (Fig. 4d). This has implications for the application of fertilizer N during the spring. In contrast to soil temperatures, the incidence of sunlight varies relatively little in different parts of the country. Therefore, while higher soil temperatures during the winter favour a longer grass-growing season in the south, there can be much less of a difference in the amount of grass grown during the year. It can be seen in Table 1 that there is little difference in the amount of grass grown in Moorepark, Co. Cork compared to Ballyhaise, Co. Cavan, although Ballyhaise is much further to the north. The implication is that at colder locations, there is much the same potential to grow grass except that it will be grown over a shorter growing season usually characterised by a huge surge in grass growth during April and May.

Table 1.The productivity of permanent grassland under simulated grazing around Ireland (*based on at least 6 years of measurement*)

Site	Production (t DM/ha/yr)	SD
Moorepark, Co. Cork	14.5	1.2
Kilmaley, Co. Clare	14.2	1.8
Solohead, Co. Tipperary	15.8	1.9
Ballyhaise, Co. Cavan	14.4	1.5
Grange, Co. Meath	13.6	1.0

In contrast to annual rainfall, which generally ranges between 1400mm in the south and west and less than 800mm in parts of the east, evapotranspiration varies very little from place to place. This is because evapotranspiration is caused by sunlight. The close relationship between the two can be seen by comparing Fig. 4(a) and Fig. 4(b). There are clear relationships between the factors that influence grass growth and hence requirements for nutrients from the soil and the factors that are likely to lead losses from the soil. During the main growing season there is huge demand for N from the soil whereas the risk of loss is limited to volatilisation of ammonia. During the winter the demand for N is low whereas the risk of denitrification and leaching is high. The important questions are (1) when to start applying fertilizer N in the late winter or spring and how much to apply? And (2) when to stop applying fertilizer N during the autumn?

Fertilizer N recommendations for grassland

The requirement for available soil N

It can be seen in Table 1 that annual grass production rarely exceeds 15 t DM/ha. The growth of 15 t of grass DM requires the uptake of at least 450 kg N/ha from the soil. Nitrogen is a key component of chlorophyll, which is where photosynthesis takes place. The uptake of at least 450 kg N/ha from the soil supplies 30 g/kg N in the grass DM, which is the minimum required for optimum photosynthesis. However, it is not necessary to supply all of this as fertilizer N. This is because soils have the capacity to supply a certain amount of N, known as background N, each year (Fig. 5a).

Background availability of N in the soil

Mineral soils (as opposed to peat soils) in Ireland contain around 8.5% organic matter (ranging between 5 and 20%) mixed in with the sand, silt and clay particles. This organic matter has accumulated in the soil over thousands of years. It is made up of decaying grass, roots and other herbage, the organic material deposited in dung and slurry etc. It is a very important component of the soil. It is the glue that holds soil together. It plays an important role in water retention and availability. It is also an important component of soil fertility, regulating the availability of many nutrients in the soil. The soil organic matter (SOM) contains around 7,000 kg of N/ha. Most (98%) of this N (SOM-N) is in a form that is not available for plant uptake. However, the SOM is constantly being turned over by earthworms and other soil organisms and this turnover makes a small amount of this N available for uptake by the sward each year (Table 2).

*Table 2. Background availability of N from grassland soils in Ireland (*K. O'Connell, unpublished data*)*

Location		*Background availability (kg N/ha/year)*
Ballinamore	Co. Leitrim	56
Kilmaley	Co. Clare	82
Clonroche	Co. Wexford	102
Oakpark	Co. Carlow	112
Kildalton	Co. Kilkenny	113
Gurteen	Co. Tipperary	113
Moorepark	Co. Cork	120
Athenry	Co. Galway	136
Clonakilty	Co. Cork	141
Solohead	Co. Tipperary	142
Tullamore	Co. Offaly	162
Grange	Co. Meath	190
Johnstown Castle	Co. Wexford	200
Pallaskenry	Co. Limerick	205
Ballyhaise	Co. Cavan	220
	Average	*140*

The background availability of N from Irish grassland soils is the subject of an on-going study by Teagasc. Early results indicate that average background availability during the growing season, spanning mid-February to the end of October, is around 140 kg N/ha/year ranging between 56 kg/ha and 220 kg/ha (Table 2). These results indicate the range in background availability of N that can be expected from Irish grassland soils. Lower quantities are associated with soils with shallow topsoil and with lighter soils. Higher quantities are associated with heavier soils and soils with deeper topsoil. Soil organic matter content and drainage status are also important characteristics.

There is a wide range in the amount of fertilizer N being used on intensive dairy farms (ranging between 225 and 400 kg N/ha for farms stocked at 2.5 LSU/ha; Fig. 1). It is fairly obvious that a large part of this difference is due to the difference in background release of N on different farms. On otherwise fertile sites, there can be a difference of 100 kg N/ha in background availability of N during the growing season (for example, Clonroche and Johnstown Castle, both in Co. Wexford). This clearly has implications for fertilizer recommendations and for the requirement of fertilizer N on farms.

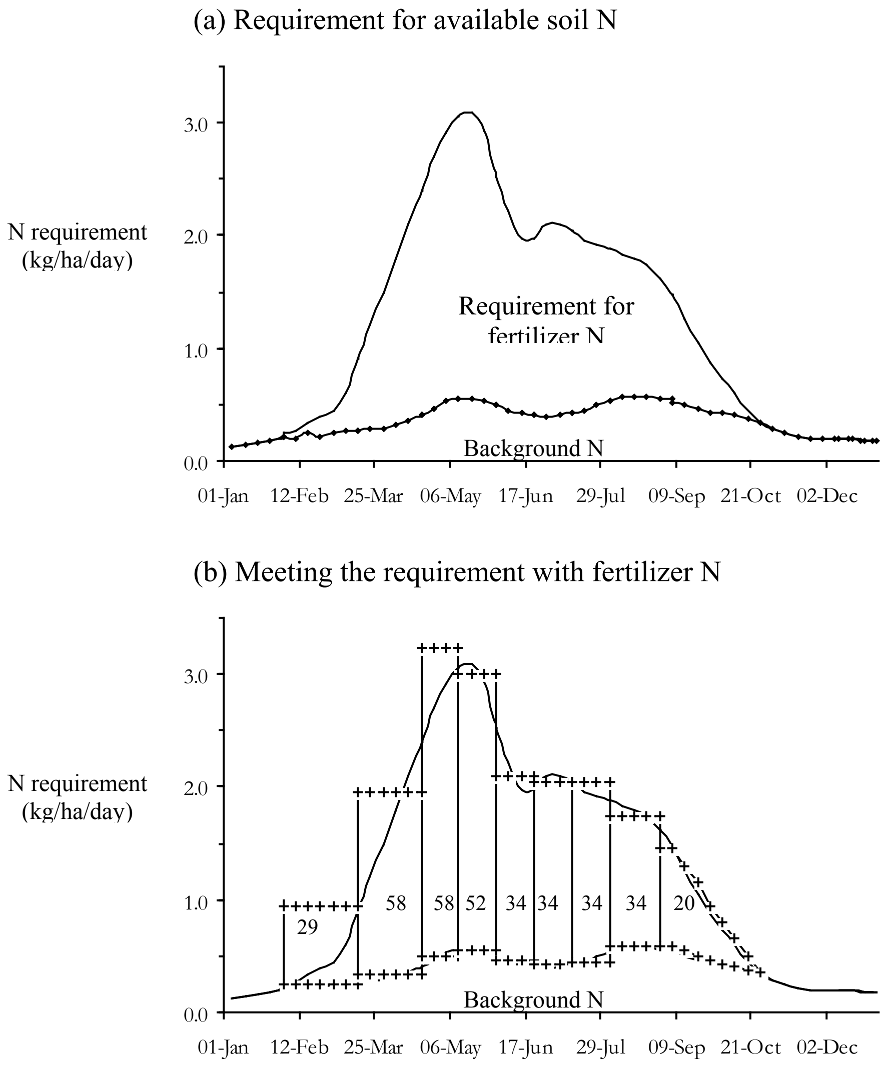

Figure 5. The annual requirement for available soil N by a sward producing 15 t DM/ha/year, and meeting that requirement from background availability of N in the soil and applied fertilizer N

The requirement for fertilizer N during the spring

The release of background N continues right throughout the year. The rate of availability is influenced by soil temperature and moisture status. Highest rates of availability are associated with the high soil temperatures during August and September once there is plenty of water available in the soil; availability is impeded by drought conditions. Lowest rates of availability occur during the winter due to cold soil conditions and waterlogging. Nevertheless, substantial quantities of background N can be made available during the winter. For example, between late October and the middle of March the background release of 43 kg N/ha has been recorded at Moorepark (O'Donovan et al., 2004). This is the equivalent of 270 g N/ha/day. Estimates of N release during the winter at Solohead and Moorepark generally range between 200 and 250 g N/ha/day during November, December and January.

In Fig. 5(a), the background availability of N based on data from Solohead and Moorepark is presented in comparison with the requirement for 450 kg fertilizer N/ha by a sward producing 15 t DM/ha/year (close to maximum potential production). It can be seen that the background release of N is able to meet the requirements of the sward during November, December and January. The release of between 200 and 250 g N/ha/day during this period is sufficient to support growth of between 600 and 700 kg grass DM/ha, or a growth rate of around 7.0 kg DM/ha/day.

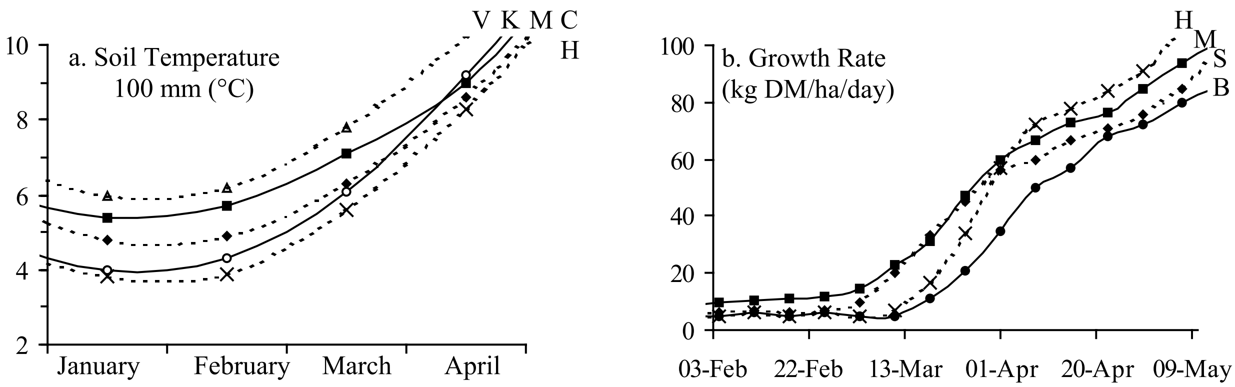

Figure 6. (a) Soil temperatures during the late-winter and spring at a range of sites in Ireland from the south west to north (V = Valencia △, Co. Kerry; C = Cork airport ◆, south Co. Cork; M = Moorepark ■, north Co. Cork; K = Kilkenny °, in the midlands & H = Clones ×, Co. Monaghan in the north) and (b) grass growth rates during the spring at a range of sites in Ireland from south to north: (M = Moorepark ■, Co. Cork; S = Solohead ◆, Co. Tipperary; H = Ballyhaise ×, Co. Cavan & B = Ballinamore •, Co. Leitrim).

At some stage during January and February the demand of the sward for available N from the soil begins to exceed the background supply. At this point there is likely to be a response to fertilizer N. As can be seen from soil temperatures (Fig. 4d; Fig. 6), this can be as early as mid-January in the southwest and as late as mid-March in the north. Over large parts of the country the point where requirement for fertilizer N begins to exceed background supply is likely to be in mid-February.

The next question that arises is how much fertilizer N to apply during the early spring? At Moorepark, O'Donovan et al (2004) showed very high production responses in terms of grass grown by 18 March to fertilizer N input of 90 kg N/ha. For experimental reasons all of this fertilizer was applied in one application. When this fertilizer was applied between mid January and early February, recovery in the sward was around 50%. Earlier application resulted in lower rates of recovery. It is fairly obvious that the reason for this relatively poor rate of recovery was due to the high levels of surplus rain (Fig. 4b) coinciding with low rates of N uptake from the soil (Fig 5). In other words around 45 kg N/ha is being lost before it ever contributed to grass production. While some losses are unavoidable, it is obvious that by splitting the application; i.e. 30 kg/ha applied in mid-January and the remaining 60 kg/ha is applied in mid-February, the risk of loss will be lowered because the bulk of the fertilizer will be applied closer to the time of high uptake by the sward. This will vary with location. Therefore, it is generally recommended that 29 kg N/ha (23 units/acre) is applied in the first application and that this is followed four to six weeks later by around 58 kg/ha (46 units/acre) depending on growing conditions (Fig. 5b). The initial application may need to be as early as mid-January in the southwest, mid-February in the midlands and the end of February in the northeast. This strategy will result in higher recovery of N by the sward resulting in more efficient use of N on the farm.

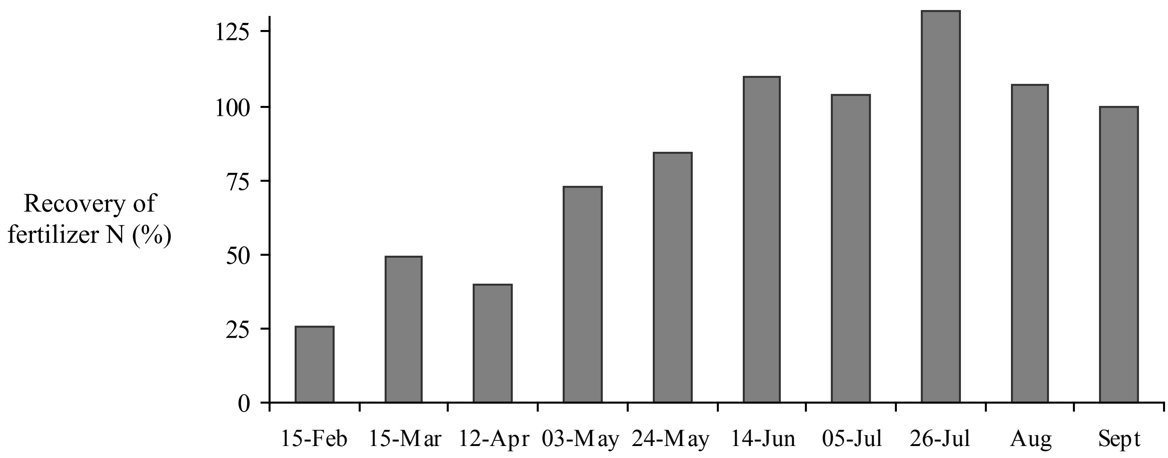

Figure 7. Recovery of fertilizer N (%) during the grazing season (O'Connell *et al*., 2004)

In Fig. 5(b) a fertilizer N application strategy to meet the demand for fertilizer N is outlined. This is based on a fairly typical approach for intensive dairy farms where half bag of urea/acre is applied in February followed by a bag of urea/acre during March and again during April. This is followed by a bag and a half of CAN/acre during early May, and a bag of CAN/acre at around four-week intervals during late May, June, July and August. A bag or half a bag CAN/acre is applied during early to mid-September. The total quantity of fertilizer N applied is around 350 kg N/ha. O'Connell et al., (2004) tested a similar application strategy where fertilizer N was applied at three-week intervals at Solohead and Moorepark. Recovery of fertilizer N was as low as 25% during February increasing to around 75% during May. Low rates of recovery of fertilizer N were attributed to the high rates of surplus rainfall during this period. From late May until late August, rates of recovery approached and exceeded 100%. This result can also be attributed to the balance between rainfall and evapotranspiration. During the summer evapotranspiration exceeds rainfall and the soil remains relatively dry. There is little risk of losses due to denitrification. Furthermore, the soil water is held in the topsoil and there is virtually no risk of leaching. Nitrate dissolved in the soil water is retained in the topsoil and available for uptake later in the season. This accounts for the rates of recovery exceeding 100% in late July. From early September onwards the rate of recovery begins to decline in line with declining grass growth and with increasing quantities of surplus rainfall entering the soil. Over the whole growing season, the recovery of fertilizer N was a little over 80%. The greatest losses of fertilizer N occurred during the springtime.

Strategies to lower fertilizer N requirements on farms

Matching fertilizer N use to stocking rate

Recent work at Solohead has shown that, with grass-only swards, around 170 kg fertilizer N/ha is required to support a stocking rate of around 2.0 LSU/ha. Average fertilizer N use on Irish dairy farms stocked at 2.0 LSU/ha is 175 kg/ha (Coulter et al., 2002). Therefore there is good conformity between the rate of fertilizer N being used on farms, generally, and that found to be necessary to support this stocking rate at Solohead. Furthermore, at Solohead, it was found that for every increase in stocking rate by 0.1 LSU/ha, an additional 30 kg N/ha was required (Humphreys et al., 2004). These results have been incorporated into the Teagasc fertilizer recommendations (Table 3).

It can be seen in Table 2 that the soil at Solohead has the capacity to supply around 140 kg background N/ha during the main growing season (mid-February to late October; a further 25 kg/ha is released during the winter period). This is similar to the national average. Taking into account the range in background availability of N from different soils, it is obvious that the fertilizer N recommendations in Table 3 are likely to be too low on farms with soils with low levels of background availability and too high on farms with high levels of background availability. Therefore the Teagasc recommendations serve to indicate the quantities of fertilizer N that are likely to be required in an average situation. It is not possible at the present time to be able to accurately delineate the extent to which the soil on a particular farm is able to supply background N.

Nevertheless, most farmers have a fair idea of the background fertility and production capacity of their farms. It is fairly obvious when not enough fertilizer is being applied on the farm; not enough grass is being grown. It is also fairly obvious when too much fertilizer is being used; when excessive quantities of surplus grass is being baled as wrapped silage, particularly where a lot of surplus grass is being baled during the second half of the growing season. It pays to cut back on fertilizer N under such circumstances. The saving in fertilizer N is small compared to the saving of not making bales.

Matching fertilizer applications to responsiveness to fertilizer N and demand for grass

Best response to fertilizer N will be achieved by applications made during late March, April and May. During this time of the year, it pays to put on high rates of fertilizer 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. Because of the high rates of grass growth during late April and May (for reasons outlined above), it is possible to make around 20% more silage per ha for more-or-less the same inputs costs compared to second-cut silage. Making a large first-cut lowers the need for second-cut silage (the economics of which is becoming increasingly questionable). Therefore a smaller area needs to be closed for second cut. This makes a greater area available for grazing providing substantial scope to lower fertilizer N inputs onto the grazing area from June onwards.

When it comes to lowering fertilizer N input to the grazing area from mid-summer onwards, one question that often arises is whether to make large applications of fertilizer at long intervals, for example, 40 kg N/ha applied once ever eight weeks, or a smaller application at shorter intervals; 20 kg/ha every four weeks. Our experience is that small and regular applications help to maintain 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 25 kg 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 3).

Table 3. Suggested fertiliser N application strategies during the growing season to the grazing area of farms with different stocking rates.

Over-all farm stocking rate (LSU/ha)	Jan/Feb (kg N/ha)	March	April	May	June	July	Aug.	Sept	Total
1.8		29	29	17		17		17	110
1.9		29	58	19		17		17	140
2.0	29	29	58	20		17		17	170
2.1	29	50	58	29		17		17	200
2.2	29	50	58	35	24	17		17	230
2.3	29	58	58	35	23	23	17	17	260
2.4	29	58	58	52	35	24	17	17	290
2.5	29	58	58	52	35	35	35	17	320
2.6	29	58	58	52	52	35	35	31	350

Teagasc has suggested a general approach to fertilizer N applications for farms where the first-cut silage is maximised and second cut silage is minimised (Table 3). The basis of these recommendations is to apply fertilizer in a way that maximises response in terms of grass grown and that this grass is supplied in line with demand on the farm. This approach is not precisely applicable on many farms because of issues such as farm fragmentation etc. and also, because of different capacities of different soils to supply background N. Nevertheless it serves to emphasise a concept. One approach that has worked very well at Solohead is to link the application of fertilizer N from June onwards with achieving target pasture covers. At high stocking rates, if grass supply remains above target, the application of fertilizer N is halved, for example from 35 kg/ha to 17 kg/ha. Under moderate stocking rates, where small amounts of N are being applied at each application, if grass supply remains above target, the application of fertilizer N is delayed for a week. If supply again remains above target, fertilizer N application is again delayed etc. This approach makes maximum use of background N and can result in savings in fertilizer N. More importantly it avoids the need to make bales. The pasture cover targets used at Solohead for moderate (around 2.0 LSU/ha) and high stocking rates (around 2.5 LSU/ha) are presented in Fig. 8.

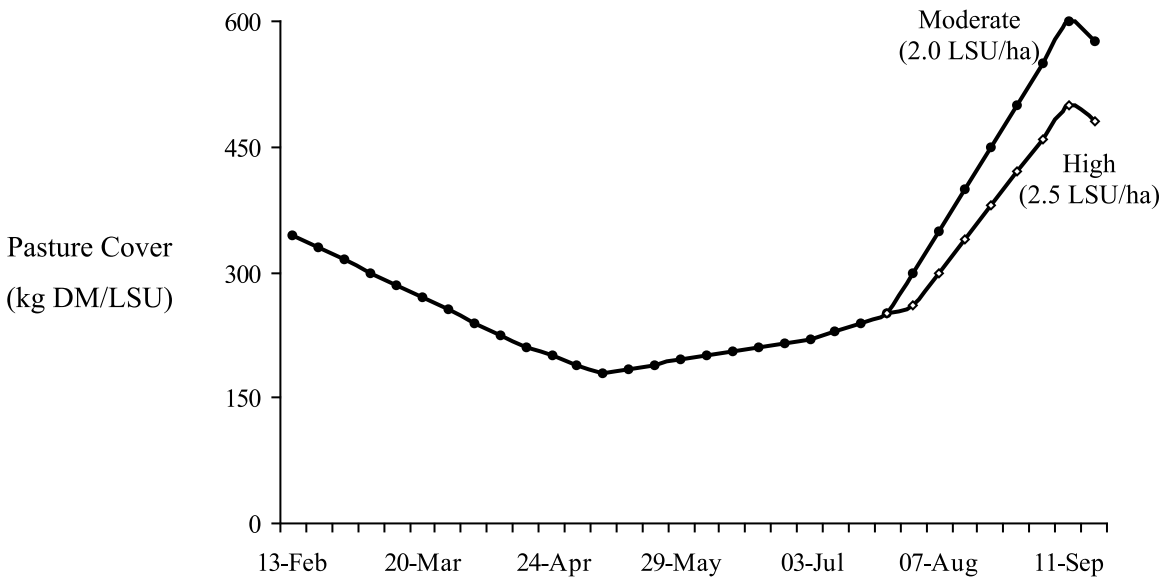

Figure 8. Target pasture covers at various stages during the grazing season

Fertilizer N application in spring and autumn

Strategies for the application of fertilizer 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 by nitrate under cold soil conditions. Urea is cheaper than CAN (i.e. €0.52/kg N compared with €0.69/kg N, at the moment). 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 be eventually converted to nitrate in the soil. Therefore the application of urea fertilizer 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 fertilizer N declines during the autumn. The reasons for this have been outlined above. In general, research has shown that there is no worthwhile response to fertilizer 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 fertilizer N later in the year. However, when fertilizer is being applied during the early spring, it is being applied in anticipation of expected growth. When fertilizer is being applied during the autumn, growth is inexorably declining. Also, not all of the applied N will be taken up in one go. Fertilizer applied in mid-September will be taken up at a rate of around 0.5 kg N/ha/day during the remainder of September and October. Therefore, it takes around 60 days for 30 kg N/ha to be taken up from the soil. By mid-November, the requirement for fertilizer N will be very low and will be within the supply capacity of the background N (Fig. 5). Therefore as the application of fertilizer N is delayed into late September or October the demand for available soil N is disappearing while the risk of loss increases exponentially.

The application of slurry

On most farms, management of slurry is more of a headache than anything else and is usually seen as a non-productive cost. However, when it comes to spreading slurry, it generally costs as much to make the best of it as it does to make a mess of it (Table 4). The best response to slurry is obtained during the spring. In many ways slurry is an ideal source of N for application during the spring. Half of the N is in the form of ammonium, which is not readily leached and is more easily taken up under cold conditions. The other half of the N is in the form of organic matter, which is very effectively held in the soil. This material has to rot away before the N is made available for uptake by the sward. The rate of release of the N in the organic material therefore increases with rising soil temperatures making N available in line with increasing grass growth. Slurry can be used very effectively to replace fertilizer N for the first application in spring. There are clear benefits associated with this. It can be seen in Table 4 that the net value of this slurry is around €5/ha (€2/acre). In contrast, applying slurry during the late autumn or early winter will result in poor utilization of the nutrients in the slurry. Under such circumstances the net cost of the disposal of this slurry is approximately €35/ha (€14/acre). On a 40 ha (100 acre) farm this difference in slurry management amounts to well over €1000 per year.

This value is based on the cost of replacing the nutrients in the slurry by artificial fertilizers that are used with high efficiently. It does not reflect the value of the nutrients in slurry when converted into pasture or into the animal products, such as milk, sold off the farm. If the nutrients in slurry were valued on this basis, the magnitude of difference between efficient use or disposal of slurry on the farm becomes much greater. The message is clear; it pays to pay attention to the management of slurry on farms.

Table 4. The impact of date of application on the utilization efficiency of the nutrients in cattle slurry, the gross value of the slurry (replacement value of artificial fertilizers) applied at a rate of 33 cubic metres/ha (3000 gals/acre) and the net cost or saving of the slurry assuming that the cost of applying the slurry is €75/ha (€30/acre)

	Nitrogen	Phosphorus	Potassium	Gross Value*	Net cost or saving
Nutrients per cubic metre (kg)	*3.2*	*0.5*	*3.0*		
Value of Nutrient (€/kg)	*0.52*	*1.35*	*0.36*		
	Utilization efficiency (%)			*(€/ha)*	
Spring (ideal)	*75*	*90*	*90*	*93*	*18*
Spring & September (typical)	*50*	*90*	*90*	*80*	*5*
Spring & September (poor)	*25*	*90*	*90*	*66*	*-9*
May to August	*5*	*90*	*90*	*55*	*-20*
October to January	*10*	*85*	*45*	*40*	*-35*

**Based on the replacement value of artificial fertilizer*

During the spring at Solohead, the entire farm is grazed between early February and mid-April. By late January, the tanks are getting fairly full with slurry. This slurry is applied to around two-thirds of the farm during late January or early February; the other one-third of the farm is used for grazing during February and early March. The slurry at Solohead is stored in outdoor earthen-bank tanks and contains around 4% DM. This diluteness of the slurry combined with high rainfall during this period ensures that the slurry is washed off the grass a long time before the cows come around to grazing, which is generally between five and ten weeks later. We have seen a good response to this slurry. With an application of around 28 cubic metres/ha (2500 gals/acre), it is estimated that this contains a total of around 75 kg N/ha, around 35 kg/ha of this is readily available as ammonium N. Around 20 kg/ha is taken up by the sward. The remainder of the ammonium N is unavoidably lost. This application of slurry replaces the 29 kg N/ha applied as urea fertilizer (much of which will also be unavoidably lost; see Figs. 5 and 7) recommended in Table 3. This application of slurry does not seem to have any detrimental effect on the acceptability of the grass to the cows.

During March and April, around half of the farm is closed up for first-cut silage. At this stage the slurry tanks are getting quite full again. Slurry is applied to around two-thirds of the silage ground during the first week of April. The other one-third of the silage ground remains to be grazed during April to complete the first rotation at some stage during the second or third week of April. The first week of April is the targeted because a lot of the silage ground will have been grazed at that stage and, assuming that the silage is harvested towards the end of May, there will be around seven weeks between application of the slurry and the harvest of silage. This lowers the risk of contamination of the silage. An application of around 33 cubic meters of slurry/ha (3000 gals/acre) supplies around 100 kg N/ha, 50 kg of which is available in the form of ammonium N. It is estimated that the sward takes up around 25 kg of this, the remainder being lost primarily by volatilisation. The amount of fertilizer N applied for first cut silage is cut back accordingly from around 115 kg/ha to around 90 kg/ha. The excessive supply of N for silage may result in poor preservation. It is better to be cautious when it comes to applying N for silage and get a slightly lower yield of good quality silage than a larger yield of poor quality material.

During the winter, dirty water is applied using a rota-rainer in the paddocks nearest the farmyard. This dirty water is very dilute because it is being generated during a time of high rainfall and the cows are not being milked between Christmas and late January. Following the application of slurry to the silage ground during early April, any dirty water generated is pumped directly into the slurry tanks and mixed with the slurry. This has the advantage of reducing work because there is no need to keep moving the rota-rainer etc. It also has the advantage of lowering the loading of dirty water on the paddocks around the yard. This fairly dilute mixture of slurry and dirty water is applied to the silage ground after first-cut silage. Any dirty water generated during the second half of the year is applied on ground harvested for second-cut or for baled silage. An important objective is to ensure that the tanks are empty before the winter. Most of the slurry at Solohead is applied by contractors using an umbilical system, which is facilitated by the farm at Solohead being all in one block.

On intensive farms, stocked at around 2.5 cows/ha, efficient management of slurry can directly lower fertilizer N used on the farm by around 35 kg/ha (or

10%) and probably accounts for some of the difference in the efficiency of fertilizer N use between different farms outlined in Fig.1.

Application of P and K fertilizers

When it comes to the application of P and K fertilizers and slurry it is important to base the rate of application on a recent soil test. Ideally around one-fifth of the farm should be sampled each year on a five-year rotation. This means dividing the farm up into five blocks of land. The management of the paddocks in each block should be reasonably similar. Each block should contain around 5 paddocks or so. One paddock within each block should be sampled each year on a rotational basis. This means that each paddock is sampled at an interval of around 5 years. This is a useful way of keeping track of what is happening within each block from year to year and within each paddock every 5 years or so. Comparing records over time provides very useful information on nutrient management on the farm such as better targeting of the P and K value of slurry to where it is needed and avoiding unnecessary applications of P and K fertilizers.

As with slurry and fertilizer N, applications of P and K should be avoided during the late autumn to avoid losses over the winter. Applications of K during the early spring to any ground used for grazing should be avoided in order to lower the risk tetany. Silage has a huge requirement for K compared to grazing ground. Where it is necessary to apply K for silage it is better to wait until after grazing and to apply it when closing up during March or early April. Much of the requirement for K by the silage can be met by the application of cattle slurry, which contains large amounts of K. An application of 33 cubic meters of slurry/ha (3000 gals/acre) supplies around 90 kg K/ha. It is also good practice to apply slurry after harvesting the silage to redress any imbalance in P and K taken off in the harvested silage. Mid-summer is also a good time to apply K to grazing ground as there is much less risk of tetany. Spaced applications of compound fertilizers such as 24-2.5-10 help to supply small amounts of K during the summer and are reasonably cost-effective as long as there is also a requirement for P in the soil. The controlled use of K fertilizer and cattle slurry can also be used to help keep docks under control.

However, best control will be achieved when paddocks are alternated between silage and grazing from one year to the next. Continually harvesting silage from the same field generally leads to the deterioration of the sward and docks running out of control.

White Clover

Down through the years, there has been much written and said about the potential of white clover in Irish grassland. Very little of this potential has been realised out on farms. The big problem has been lack of persistency of white clover under Irish conditions. There are many reasons for this including the use of herbicides and high rates of fertilizer N. However, the fundamental problem is that white clover has an average life expectancy of around five years in grassland managed to promote productive white clover. White clover cannot be seen to be persistent in the same way as permanent grassland. Individual clover plants die off and need to be replaced at regular intervals, rather like bringing replacements into a herd of cows. Ongoing research at Solohead has shown that this can be achieved at very little cost by mixing pelleted white clover seed with a P&K fertilizer and spreading it onto first-cut silage stubble using a fertilizer spreader. Around one-fifth of the farm is over-sown on a five-year rotation. This maintains highly productive white clover swards from year to year. Recent on-going research is showing that this approach is also working well on a number of farms.

At Solohead white clover swards receiving 90 kg N/ha/year (72 units/acre) are able to support a stocking rate of 2.2 cows/ha producing 6,250 litres of milk per cow, or around 13,750 litres per ha (over 1200 gals/acre). The equivalent stocking rate on grass-only swards requires fertilizer N input of around 230 kg/ha (Table 3). This indicates that white clover provides the potential to lower fertilizer N input by around 140 kg/ha. This N is supplied through the fixation of atmospheric N by Rhizobium bacteria that live in nodules in the roots of white clover. On a whole-farm basis, the annual cost of over-sowing is around €10/ha and the annual saving in fertilizer N is around €100/ha, which is an annual net saving of €90/ha (€36/acre). Although, this potential may not be achievable on all farms, it is realistic to expect that white clover will lower fertilizer N requirement on moderately stocked farms by around 90 to 100 kg/ha with an associated net saving of around €65/ha (€26/acre).

Teagasc National Farm Survey data indicates that 70% of the milk produced in Ireland is produced on farms stocked at less than 2.0 LSU/ha (Connolly et al., 2001). Around 98% of beef and sheep farms are stocked at less than 2.0 LSU/ha. On a national basis, around 93% of grassland farms are stocked that less than 2.0 LSU/ha. This indicates the huge potential of white clover to lower fertilizer N inputs to grassland in Ireland.

Summary

The Nitrates Directive and other legislation is creating pressure to lower fertilizer inputs and increase the efficiency of nutrient-use on farms in Ireland. 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. Improvements can be made by closely matching fertilizer inputs to stocking rates, avoiding the need to harvest surpluses as baled silage and by maximising the utilization of background availability of N in soils. Close attention is needed to avoid losses of fertilizer during the spring and autumn. This can be achieved during the spring by applying fertilizer at rates and at times that anticipate increasing demand for soil nutrients by the sward. Slurry can also be used to effectively replace fertilizer during the spring. During the autumn it is necessary to apply the last application of the season early enough to ensure that there is sufficient time remaining in the growing season for most the fertilizer to be taken up by the sward. This means applying fertilizer N before mid-September. High rates of loss can be expected with later applications because of the very high levels of surplus rainfall that can be expected during October, November, December and January. White clover has the potential to supply up to 140 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 immense potential to lower the requirement for fertilizer N on farms.

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Crossbreeding International Experience

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University of Minnesota

The perceived decline in fertility and survival of pure Holsteins led owners of seven large dairies in California to mate Holstein heifers and cows with imported semen of the Normande and Montbeliarde breeds from France and of the Norwegian Red and Swedish Red breeds. Because the Norwegian Red (NRF) and Swedish Red (SRB) breeds share similar ancestry and freely exchange sires of sons, we have regarded the two breeds collectively as "Scandinavian Red". Crossbred cows began calving in June 2002, and all early crossbreeds were Normande-Holstein. Montbeliarde-Holstein and Scandinavian Red-Holstein crossbreeds began calving about one year later than the Normande-Holstein crossbreeds. Some cows in the seven California dairies remained pure Holstein, which has permitted comparison of pure Holsteins and crossbreeds.

Production

All cows calved from June 2002 to December 2003 for a study of the production of crossbreeds versus pure Holsteins. Sires of all cows were AI sires with assigned sire codes. Furthermore, the Holstein maternal grandsires of all cows (both pure-bred and crossbred) were likewise required to be AI sires with assigned sire codes. This edit removed all cows from the study that had natural service Holstein sires or maternal grandsires and provided for a fairer comparison.

The analysis of daily production data from milk recording made adjustment for stage of lactation within breed (five 30-day intervals from calving to 150 days postpartum), age at calving, herd-year-season of calving (3-month seasons), milking frequency, and breeding value of each cow's Holstein maternal grandsire. Effects of breed composition, sire, and cow (within breed and sire) were key factors in the statistical analysis. Table 1 has a summary of the number of daily observations from milk recording, cows, and sires represented in the production data.

Table 1. Number of observations for production.

Breed	Monthly observations	Cows	Sires
Holstein	1248	294	61
Normande-Holstein	758	171	20
Montebeliarde-Holstein	611	174	20
Scandinavian Red-Holstein	470	120	8

Results for production during the first 150 days of lactation of first lactation cows are provided in Table 2. Only results for the first 150 days of lactation are reported to date, because 305-day lactational production of cows will need to be adjusted for differences in reproductive status. Cows with very short days open are penalized for 305-day production, and cows with long days open or do not become pregnant have inflated 305-day production. Results for 305-day production adjusted for days open will be published in early 2005.

Table 2. Average daily production during the first 150 days of first lactation.

	Holstein	Normande-Holstein	Montebeliarde-Holstein	Scandinavian Red-Holstein
Milk (kg)	32.0	28.6	31.5	33.3
Fat (kg)	1.10	1.01	1.12	1.17
Protein (kg)	.95	.89	.96	1.01
Fat + Protein (kg)	2.04[a]	1.91[b]	2.08[a]	2.18[c]
% of Holstein		-6%	+2%	+7%

The pure Holsteins and crossbreds were comparable for daily production, which was gauged as fat plus protein (kg). The Montbeliarde-Holstein crossbreds and pure Holsteins were not significantly different for production; however, there was a tendency for the Montbeliarde-Holstein crossbreds to have higher production (+2%). The Normande-Holstein crossbreds had 6% less production and the Scandinavian Red-Holstein crossbreds had 7% more production than pure Holsteins, and these differences were statistically significant.

Some have questioned the genetic level of the sires of the pure Holsteins; however, these California dairy producers have always used high-ranking A.I. sires. The current average breeding values of the sires of the pure Holstein cows in this study are +1106 kg milk, +30 kg fat, +34 kg protein, despite the fact that the cows were born several years ago.

The somatic cell scores for the pure Holsteins were compared to those for the crossbreds; however, averages were uniformly low for each group, and averages for somatic cell scores were all less than 65,500 for each breed combination. The data were first-lactation cows during the first 150 days of lactation; therefore, meaningful differences in somatic cells will probably require information for more cows later in first lactation as well as during subsequent lactations.

Calving difficulty and stillbirths

Number of observations for births was much greater than for production. Calving difficulty was measured on a 1 to 5 scale, with 1 representing a quick and easy birth without assistance and 5 representing an extremely difficult birth that required a mechanical puller. Stillbirths were recorded as alive or dead within 24 hours of birth. It is important to keep in mind that calving difficulty and stillbirth are traits of both the sire and the dam.

For analyzing effects of breed of sire, dams of calves were limited to first-calving pure Holsteins. Adjustments were made for sex of calf and herd-year-season of calving. Across breed of sire, calving difficulty averaged 1.74 for bull calves and 1.38 for heifer calves, and stillbirth rates were 15% for bull calves and 4% for heifer calves. Clearly, the bulk of calving difficulty and stillbirths were for bull calves. Table 3 provides the number of births, average calving difficulty score, and average stillbirth rate by breed of sire. A total of 1,711 births were included in the analysis; however, the number of births by Jersey (51) and Normande (30) sires were modest during the period of time from June 2001 to December 2003.

Table 3. Average for calving difficulty and stillbirths for breed of sire.

Breed of sire	Number of births	Calving difficulty	Stillbirth rate
Holstein	339	1.76^{a}	$.15^{a}$
Normande	30	$1.68^{a,b}$	$.08^{a,b}$
Montebeliarde	160	1.67^{a}	$.11^{a,b}$
Brown Swiss	209	$1.57^{a,b}$	$.11^{a,b}$
Scandinavian Red	922	1.46^{b}	$.07^{b}$
Jersey	51	1.22^{b}	$.04^{b}$

All dams were first-lactation Holsteins.

Average score for calving difficulty was significantly less for Scandinavian Red sires (1.46) and Jersey sires (1.22) than Holstein sires (1.76); however, all breeds of sire tended to have less calving difficulty than Holstein sires. Furthermore, Scandinavian Red sires (7%) and Jersey sires (4%) had significantly fewer stillbirths than Holstein sires (15%); however, all breeds of sire tended to have fewer stillbirths than Holstein sires. It is important to remember that all dams of calves were first-calving Holsteins, so calves sired by Holstein sires were purebreds, whereas calves sired by bulls from the other breeds were crossbreds. Therefore, inbreeding within breed could have influenced the higher rate of stillbirth for Holstein-sired calves.

To estimate differences in breed composition of dam for calving difficulty and stillbirths, breed of sire was limited to Brown Swiss, Montbeliarde, and

Scandinavian Red sires, because numbers of births by sires of other breeds were small and not well distributed across breed composition of dam. Therefore, all births analyzed for breed of dam were for crossbred calves. Adjustments were made for breed of sire, sex of calf, and herd-year-season of calving. Across breed composition of dam, calving difficulty was 1.67 for bull calves and 1.31 for heifer calves, and stillbirth rates were 12% for bull calves and 2% for heifer calves. Bull calves caused more problems than heifer calves. Table 4 has results for 1,809 births by breed composition of dam.

Table 4. Average for calving difficulty and stillbirths for breed of dam.

Breed of dam	Number of births	Calving difficulty	Stillbirth rate
Holstein	1291	1.61^{a}	.10
Normande-Holstein	227	$1.52^{a,b}$	.07
Montebeliarde-Holstein	170	$1.50^{a,b}$	.07
Scandinavian Red-Holstein	121	1.32^{b}	.05

Scandinavian Red-Holstein crossbreds (1.32) had significantly less calving difficulty than pure Holsteins (1.61); however, the Normande-Holstein dams (1.52) and Montbeliarde-Holstein dams (1.50) tended to be intermediate between Scandinavian Red-Holstein dams and pure Holstein dams for calving difficulty. None of the averages for stillbirth rate were statistically different; however, the stillbirth rates tended to follow the averages for calving difficulty respective to breed composition of dam, and Scandinavian Red-Holstein dams had a stillbirth rate that was half that of pure Holstein dams.

Survival and fertility

Only Normande-Holstein crossbreds were compared to pure Holsteins. In early 2005, adequate numbers of Montbeliarde-Holstein and Scandinavian Red crossbreds will be far enough along in first lactation to provide for comparisons. First-lactation cows in the seven California dairies that calved from June 2002 to May 2003 were compared for survival to first test for milk recording, to 150 days postpartum, and to 305 days postpartum. Survival rates were adjusted for age of cow at calving within breed and herd-season of calving. Table 5 has the survival rates for pure Holsteins and Normande-Holstein crossbreds. The 305-day survival rate for Holsteins is in general agreement with national statistics in the USA, and the 305-day survival rate of the Normande-Holstein crossbreds is nothing short of amazing. These survival rates are for 787 pure Holsteins and 315 Normande-Holstein crossbreds, and it will be interesting to see if the huge difference in survival rates holds as more Normande-Holstein crossbreds become available.

Table 5. Survival during first lactation.

Measure	Holstein	Normande-Holstein	Difference
First test	.96	1.00	.04
150 days	.86	.99	.13
305 days	.78	.95	.17

Breed difference was significant in all cases.

Fertility of the pure Holsteins and Normande-Holstein crossbreds was measured as actual days open for cows that had a subsequent calving or had pregnancy status confirmed by a veterinarian. To be included in the analysis, cows were required to have at least 250 days in lactation, which means the Holsteins were a more highly selected group compared to the Normande-Holstein crossbreds, because a smaller percentage of them survived to 250 days postpartum. Cows with more than 250 days open had days open set to 250. Adjustment was made for herd-season of calving, and 547 pure Holsteins and 298 Normande-Holstein crossbreds were compared.

The distribution of days open for cows indicated 41% of the pure Holsteins versus 52% of the Normande-Holstein crossbreds had 35 to 99 days open. Furthermore, 23% of the pure Holsteins versus 10% of the Normande-Holstein crossbreds had at least 250 days open. The 547 pure Holsteins had average days open of 143, and the 298 Normande-Holstein crossbreds had average days open of 126. The difference of 17 days open was statistically significant. A difference of this magnitude for fertility, coupled with the difference for survival, more than compensates, economically, for 6% less production of Normande-Holstein crossbreds than pure Holsteins.

Final Comments

Crossbreeding is NOT genetic improvement. Continuous use of top A.I. sires internationally is the key for genetic improvement. However, hybrid vigor is a bonus that dairy producers can expect on top of the individual gene effects from use of top A.I. sires within breed. The bonus from hybrid vigor appears to be about 6.5% for production and at least 10% for fertility, health, and survival of dairy cows. Most crossbreeding systems should use more than two breeds to make maximum use of hybrid vigor. Optimum breeds for crossbreeding in low-input production systems likely include Holstein, Jersey, Normande, Norwegian Red, and Swedish Red.

Farmer's Perspective on Discussion Groups

John Sheridan, Cornakil, Mullagh

I have been involved in some form of group in a long time and always felt a benefit.

First big benefits seen:
Winter period shortened indoors from 5 months to 3.5 months.
Main emphasis changed from quality silage, 3 cuts and 10 ton per livestock unit to quality grass management, 8 grazings and 5.5 tons silage.

The greatest gain only happened when there was sharp focus on whys:
Why you should understand total farm cover.
Why you were or were not achieving target intake.
Why your costs were rising or lowering.
Why you were spending so much time doing so little (time management).
Why you didn't have a map plan for 1 year – 5 years, long term.

Progress only could be made on answers when members knew where they were, and where they were going. Having accounts and understanding them is crucial.

Social aspect:
Meeting a group of farmers like yourself and at least having your ideas bounced off them. Working together, not in competition.

Best progress is made if there is a program for each year. Getting to understand growth rate, grass measurement, matching supply and demand. Host farmers should be prepared to make accounts available and members should help trash out why certain costs are high or output is low and put a plan into place. Are veterinary costs high because of bad roadways, congested housing, stress at milking because of cow flow, etc.?

It is only when farmers get something worthwhile from a group visit that they become committed and are anxious to continue participation. Improvement in profit, efficiency or life style will cover what most farmers want. I would have benefited from all (well I don't know about life style).

I would not see any specific system as a passport to riches, let it be low input, elite breeding or whatever. What I believe important when a group meet on a farm they identify the strength, weakness, opportunity and threat to the farm, (and farmer) and help put a plan together to exploit the strength and overcome the weakness.

Less positive observation:
Groups can become a talking shop if not kept focused. It's easy talking about the common market, white-collar workers, the American election, what's going to happen in 2015? I believe facilitators need special training. Farmers for whatever reasons don't take easily to figures, cm., kg, dry matter intake, growth rate, demand, fixed cost, variable cost, % retained. To exploit the new era everyone will need to become familiar. It won't happen with a continuation of the old system. Facilitators, (instructors I presume) will need training to get the best from groups and keep them motivated.

There are a couple of foreign areas discussion groups could become involved in if there was enough interest: Investments, alternative enterprise and farm business outside the farm gate are what I have in mind here.

There are not enough young people involved in farm politics or in farm owned agri business. Inefficient farming survived for many years after joining the common market because of rising prices. Milk has dropped 30 cent from it's peak in the mid 90's wouldn't it be a shame if inefficiency in our processing

industry caused it to drop every time a few cents were needed. I don't think it's in the best interest of young farmers to have older men retiring to co-op boards or farming politics.
Discussion groups could be a good training ground for likely candidates.

We are very lucky in having a terrific independent research institute. It isn't enough to have a group of masters, doctors and professors indulging in all their knowledge; it must have a better avenue out to farms through extension services, discussion groups, etc. If there is an acute problem on farms, a commercial interest will probably always get involved with a product to be promoted. However, most of the best advice that companies will give will have reference to Teagasc research. There is a need for a fairer divide between research and farm services.

I believe discussion groups can be a great tool but like all good tools they need care and attention.