Irish Grassland Association Journal

2008 VOLUME 42

Irish Grassland Association

JOURNAL

Vol. 42 2008

Edited by
David McGilloway

ISSN 2009-1478

Printed by Modern Printers, Kilkenny

IRISH GRASSLAND ASSOCIATION
CORPORATE MEMBERS 2008

ACCBank
ACORN Independent Merchants
AIB Bank
AIBP
Barryroe Co-Operative Ltd
Bord Bia
Dairygold
Dairymaster
Dawn Group
Delaval Limited
Drinagh Co-Operative
FBD Insurances
Farrelly & Mitchell Business Consultants
Germinal Ireland Ltd
Glanbia
Goldcrop Limited
Grassland Fertilizers Limited
Goulding Fertilizers Limited
Irish Cattle Breeding Federation Society Limited
Irish Dairy Board
Irish Farmers' Journal
IFAC
Interchem
IFPMedia
Kerry Group
LIC Ireland Limited
McQuinn Consulting
Monsanto Ireland Limited
Mullinahone Co-op
Novartis
Origin Enterprises
Packo Fullwood
Richard Keenan & Co. Ltd
Teagasc
Ulster Bank
Wexford Milk Producers
Zero Grazing Systems Limited

CONTENTS

COUNCIL OF IRISH GRASSLAND ASSOCIATION 2008

President	William Kingston
Vice-President	Pearse Kelly
Past-President	John Donworth
General Secretary	Mary-Clare French

Council Members

Brendan Barnes, Kevin Commins, Andrew Cromie, Paul Crosson, Philip Donohue, Michael Doran, John Donworth, Jim Dwyer, Edward Egan, Sean Flanagan, John Fitzgerald, Jan Fredericks, Padraig French, Deirdre Hennessy, Brendan Horan, Tim Keady, Jack Kennedy, Andrew Moloney, Nicholas McGill, David McGilloway, Eddie O'Donnell, Frank O'Mara, Tony Pettit and Robin Talbot.

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

Crossbreeding the dairy herd – a real alternative

Frank Buckley[1], Noreen Begley[1], Robert Prendiville[1], Ross Evans[2] and Andrew Cromie[2]
[1]*Moorepark Dairy Production Research Centre, Teagasc, Fermoy, Co. Cork, Ireland.*
[2]*Irish Cattle Breeding Federation, Bandon, Co. Cork, Ireland.*

Summary

- The cow required for future Irish milk production systems must be robust and 'easy care' as well as being capable of producing high milk solids, the majority of which must come from grazed grass.
- Crossing the Holstein-Friesian with an alternative dairy breed sire can provide farmers with an alternative opportunity to increase overall animal performance by increasing herd health, fertility and milk value. This is due to the introduction of favourable genes from another breed and through hybrid vigour.
- Genetic gain must not be neglected i.e. only the best sires of both breeds should be used when crossbreeding. That ultimately means using high EBI.
- Two studies are currently underway at Moorepark evaluating the potential of dairy crossbreeding: one study is evaluating the Norwegian Red and Norwegian Red crossbred cows across 46 commercial dairy herds, and the second trial is evaluating the Jersey and Jersey crossbreds at Ballydague. In both studies the cows have just completed the 2nd lactation.
- Early results from the Norwegian Red on-farm study show that Holstein-Friesian×Norwegian Red cows produce similar milk yields with similar milk protein content but slightly lower milk fat content compared to Holstein-Friesian cows. The yield of milk produced by the pure Norwegian Reds was slightly lower, and again with lower fat content. Crossbred cows also displayed similar live weight to the Holstein-Friesian but had higher body condition score at all stages of lactation. Fertility performance was significantly better with both the pure Norwegian Reds and the crossbred cows compared to the Holstein-Friesian. Udder health was also in favour of the Norwegian Red and crossbred cows.
- The second year results from the Ballydague Jersey trial reaffirmed for the most part the findings of year one. Similar to year one, milk volume was highest with the Holstein-Friesian and lowest with the Jersey. However, substantially higher milk constituents with the Jersey and Jersey crossbred compared to the Holstein-Friesian resulted in a similar yield of solids for all 3 breed groups. Jersey and Jersey crossbred cows were lighter than Holstein-Friesian cows but maintained higher body condition score at all stages of lactation. Fertility performance was in favour of the Jersey crossbred cows.

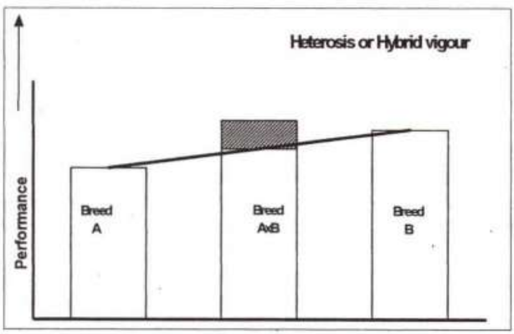
- Both Norwegian Red and Jersey calves are easily born and early maturing (data not presented for latter but research data available).
- These preliminary data suggest that crossbreeding with the Norwegian Red or Jersey are real options for Irish dairy farmers in terms of improving herd profitability.
- Reliable EBI values are not yet available on all alternative breed sires. For the most part this is due to a lack of data. When examining EBI values for these sires it is essential that reliability figures be consulted. Conversion proofs for Jersey and Norwegian Red sires are expected to be available shortly.
- The EBIs published for alternative breed sires do not include hybrid vigour. Typically, approximately €100 can be added to the EBI value of Jersey and Norwegian Red sires to estimate the EBI value that might be expected when these sires are mated to Holstein-Friesian cows.
- Options currently available in terms of breeding the first cross (F_1) cow include: 1) Back crossing i.e. mating to a bull of one of the original two breeds, 2) use a sire that is crossbred, and 3) use a sire of a third breed. Regardless of strategy only high EBI sires should be used.

Introduction

Until recently, in the world of dairy cattle breeding, the term "high genetic merit" was synonymous with high milk production potential. Now it is acknowledged that the term 'high genetic merit' should reflect as many characteristics as are required to reflect total economic profitability. In particular the greatest challenge is to overcome the decline in reproductive efficiency that has been observed in the Holstein-Friesian as a result of past selection programs that were geared towards maximising production potential. Although many countries have diversified their breeding goals to include measures of survivability or functionality, it is arguable that few have weighted fertility sufficiently to counteract the decline. Even in Ireland where the weighting on 'fertility' is currently at 37%, change will take some time (realistically many decades). Poor fertility performance is the primary constraint to maximising profitability from our seasonal grazing system because of i) an inability to capitalise on a long grazing season (due to delayed calving), ii) shorter lactations and iii) a limited supply of replacement heifers. The potential to expand in an era post quota is compromised currently and exacerbated even more by the fact that profit will be maximised post-quota with a slightly earlier mean calving date than that recommended here to fore. The "high genetic merit" cow going forward must have an innate ability to deliver a high volume of milk solids per ha, and a propensity to do this almost entirely from grazed grass. She must be robust and 'easy care', and given the seasonal nature of the Irish production blueprint, optimal performance requires a 365-day calving interval and an empty rate after the breeding season (12 to 13 weeks) of less than 10%. Recent research carried out by Moorepark suggests that crossbreeding may offer what is often referred to as a quick fix solution (relatively speaking). However, utilising the best available genetics ultimately based on the EBI, from appropriate 'alternative' breeds is essential to ensure real genetic improvement.

Fundamentally a successful crossbreeding strategy aims to; a) introduce favourable genes from another breed selected more strongly for traits of interest, b) remove the negative effects associated with inbreeding depression, and c) for many traits to capitalise on what is known as heterosis or hybrid vigour (HV). Hybrid vigour means that crossbred animals usually perform better than that expected based on the average of their parents (Figure 1). Hybrid vigour will generally be higher in traits related to fitness and health i.e. traits which have lower heritabilities.

Figure 1. Heterosis or hybrid vigour is defined as the advantage in performance of crossbred animals above the mid-parent mean of the two parent breeds



New Zealand is probably the best example of where crossbreeding is used to a large extent to capitalise on the benefits of HV. There, the Black and White and Jersey breeds in many respects are very similar having been selected through a common index for many years. In their scenario the added performance obtained through HV is seen as a prudent means of achieving higher profitability. In New Zealand HV values of up to 5-6% are observed for production traits and values of up to 18% for reproduction and health traits are observed. Put simply, in New Zealand 20% more crossbred cows survive to 5th lactation compared to Holstein-Friesians. Thus, almost 50% of heifers entering herds in New Zealand in recent years are crossbred and this is increasing.

Crossbreeding research at Moorepark

Since 1996, studies have been run at Moorepark evaluating the merits of a number of alternative breeds for crossbreeding under Irish conditions. The ultimate aim of the research is to provide a greater insight into the potential of these breeds via crossbreeding and to assist the identification of a greater variety of top EBI (high profit sires) for use by Irish dairy farmers. The breeds of particular interest currently are the Norwegian Red (NRF) and the Jersey (J). The studies underway will assist the development of an across breed evaluation. Paramount is the requirement to determine the relative breed effects (difference between alternative breed and the Holstein-Friesian), and the level of HV observed in the crossbred. Two studies are underway, 1) evaluation of NRF and NRF crossbreds across 46 commercial dairy herds, and 2) evaluation of Jersey and Jersey crossbreds at the Moorepark Ballydague research farm. The animals in both studies have just completed second lactation and results from both studies suggest a favourable response from crossbreeding.

Evaluation of Norwegian Red and Holstein-Friesian×Norwegian Red

NRF cows have been on trial at the 'Ballydague' research farm since 2001. Interest in evaluating the breed arises from the fact that since the 1970's female fertility, resistance to mastitis, and other functional traits have been included in the breeding program of the breed. The relative weighting for the traits in the NRF index currently stands at 15% for female fertility, 22% for mastitis resistance, and 23% for protein yield. This relatively low level on milk production is thought by Norwegian geneticists to be critical in getting the balance right between selection for milk production and functionality. Progeny testing for fertility and health traits is based on large daughter groups (over 200 daughters per sire). Since 2001, the cows at Ballydague have performed well. The reputed characteristics of the breed; ease of calving, high female fertility and low SCC/mastitis incidence have been observed with the small numbers on trial. Therefore, in 2004 a large-scale study was set up by Moorepark involving the importation of almost 400 purebred NRF heifer calves. These animals were spread across 50 dairy farms and along with a similar number of crossbreds (HF×NRF) and Holstein-Friesians (HF), and now form part of one of the most unique research studies in the world; a very comprehensive study aimed at conclusively evaluating the merits of the NRF breed and the potential benefits of crossbreeding under Irish conditions. Currently the study includes just over 1300 cows across 46 herds. The Norwegian and crossbred cows are sired by 10 proven bulls. The HF group represent a mix of HF genetics from around the world, having been sired by a broad spectrum of North American Holstein, New Zealand and British Friesian type sires. All cows on the trial were born in 2004 and calved for the first time in the spring of 2006.

Milk production and udder health

Milk production data for second lactation is shown in Table 1. The 305 day predicted milk yield of the HF and HF×NRF was similar at 6194kg and 6081kg, respectively. That of the pure NRF was slightly lower at 5867kg. The level of HV is indicated to be around 50kg of milk or about 1%. Fat content was highest for the HF at 3.95%, slightly lower for the pure NRF and crossbred cows at 3.90%. Milk protein content was not different across groups averaging 3.49% for all three groups. SCC was lower for the pure NRF cows compared to the HF and HF×NRF. Based on information provided by participating herds the NRF and HF×NRF also had slightly better udder health as indicated by a lower proportion of cows recorded with mastitis at least once during lactation.

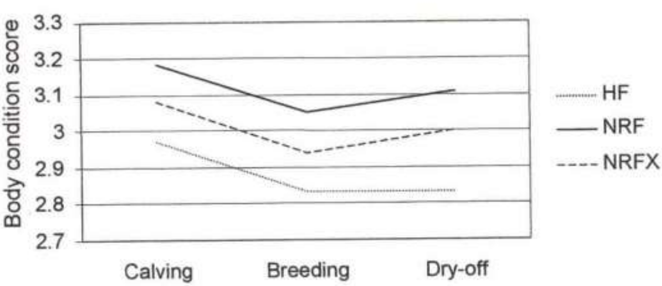
Table 1. Effect of breed group on 305 day milk production parameters and udder health.

	HF	HF × NRF	NRF
Milk yield (kg)	6194	6081	5867
Milk yield (gallons)	1323	1299	1253
Fat (%)	3.95	3.89	3.90
Protein (%)	3.48	3.49	3.49
Fat + protein yield (kg)	458	447	432
Lactation average SCC	186,000	179,000	153,000
Incidence of mastits (%)	13	11	10

Body condition and live weight

Body condition score (BCS) and live weight were measured on three occasions during 2006; pre-calving, during the breeding season, and at dry-off. The NRF consistently had the highest BCS; 3.18 pre-calving, 3.05 at breeding, and 3.11 at dry-off (Figure 2). Comparable values for the HF were 2.97, 2.83 and 2.83. The BCS of the crossbreds on the occasions averaged 3.08, 2.94 and 3.00. Averaged over lactation HV for BCS is estimated at less than 1%.

Figure 2. Body condition score pre-calving, during the breeding season and prior to dry-off for the HF, NRF×HF and NRF



The NRF consistently had the lowest live weight; (549kg pre-calving, 501kg at breeding, and 574kg at dry-off), approximately 20kg lighter than the crossbred cows at all stages. Except at dry-off (585kg v. 592kg; in favour of the HF×NRF) the HF and HF×NRF tended to have similar weights. Consistent with the increases in BCS during late lactation, the NRF (73kg) and HF×NRF (73kg) cows gained more weight compared to the HF cows (65kg) from mid lactation. Hybrid vigour estimates averaged less than 2% for live weight over lactation.

Reproductive efficiency

Fertility performance including all cows in the 46 herds was as follows: pregnancy rate to first service was 50%, pregnant after 6 weeks was 59%, and the in-calf rate after 16 weeks breeding was 85%. A comparison of the study animals only reveals a significant benefit to crossbreeding. While, the calving to service interval for all groups was not different (averaging 73 days) large differences in pregnancy rates were observed. The pregnancy rate to first service was 46% for the HF and 55% and 56% for the NRF and HF×NRF, respectively. The proportion of cows pregnant after 6 weeks was also in favour of the NRF and HF×NRF at 68% and 71%, respectively, compared to 58% for the HF. Empty rates at the end of breeding were 16%, 13% and 13% for the HF, HF×NRF and NRF cows, respectively. However, had the breeding season on each herd been restricted to 13 weeks, the empty rates of the HF, HF×NRF and NRF cows would have increased by a further 4%, 1% and 2%, respectively. Based on the data collated, differences in calving to conception intervals between the breed groups indicate a slippage of 7 days in calving interval for the HF in second lactation. However, in total, a difference of 13 days has now developed between the HF and the crossbred cows in terms of expected calving date in 2008. Both the pure NRF and crossbred cows are expected to maintain a 365-day calving interval. Survival from first to third lactation has also been estimated to be 67% for the HF, 74% for the crossbreds and 78% for the pure NRF cows.

Table 2. Effect of breed group on reproductive efficiency and survival.

	HF	HF × NRF	NRF
Mean calving date 2007	Mar-01	Feb-25	Feb-25
Calving to 1st service interval (days)	74	72	71
Submission rate in the 24 days (%)	39	60	55
Pregnancy rate to 1st service (%)	46	56	55
Pregnancy rate after 6 weeks breeding (%)	58	71	68
Empty rate (%)	16	13	13
Empty rate (13 weeks) (%)	20	14	15
Calving to conception interval (days)	92	83	85
Number of services per cow	1.82	1.63	1.59
Expected calving date 2008	Mar-08	Feb-23	Feb-25
Survival from 1st to 3rd lactation (%)	67	74	78

Evaluation of Jersey and Jersey×Holstein-Friesian at Ballydague

Worldwide, the Jersey is one of the most popular breeds after the Holstein-Friesian. In Ireland, many are asking if the Jersey (Jersey cross) is the cow of the future. Interest is being fuelled by the breed's popularity in New Zealand. There crossbreeding with the Jersey is considered to leave the most profit; high solids production at high stocking rates, coupled with increased survival.

At the Moorepark 'Ballydague' research farm, 2006 saw the introduction of 28 purebred Jersey (J) and 29 crossbred Jersey heifers (HF×J). These were introduced along side 30 HF heifers. As with the Norwegian on-farm study, these animals have just completed their second lactation. The Jersey cows at Ballydague are by sires from both New Zealand and Denmark.

Table 3 outlines the milk production performance recorded at Ballydague during 2006. Mean calving date was February 22. A total of 275kg of concentrates per cow were offered during lactation. As illustrated, differences in both milk yield and milk composition were observed across the breeds/crossbreeds. Milk yield ranged from 5612kg for the HF cows to 4329kg for the J cows. The HF×J cows were intermediate at 5014kg. Large differences in milk fat content were also evident; 3.90% for the HF, 5.36% for the J, and 4.73% for the J×HF. The J also had the highest milk protein content at 3.98%, compared to 3.41% for the HF and 3.76% for the J×HF. However, in terms of milk solids (fat + protein yield) no significant difference was observed between the breed groups, although numerically a higher yield was observed with the HF×J. Udder health as indicated by somatic cell count (SCC) was excellent for all breed groups. For the second year running, the incidence of mastitis was lowest with the crossbred cows.

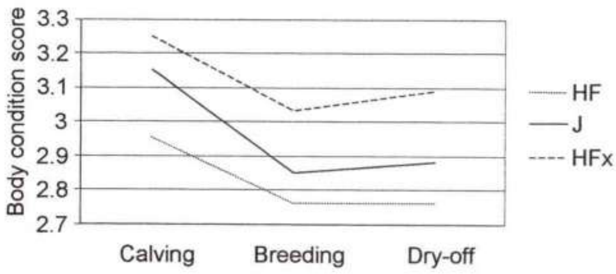
Table 3. Effect of breed group on milk production parameters and udder health (second lactation cows)

	HF	HF × J	J
Milk yield (kg)	5612	5014	4329
Milk yield (gallons)	1199	1071	925
Fat (%)	3.90	4.73	5.36
Protein (%)	3.41	3.76	3.98
Fat + protein yield (kg)	410	427	404
Lactation average SCC	79	81	141
Incidence of Mastitis (%)	29	11	27

Body condition and live weight

Figure 3 shows the average BCS of the HF, HF×J and J cows at Ballydague at a similar time period to that shown above for the cows on the Norwegian Red crossbreeding study. BCS was lowest at all stages with the HF, and highest with the HF×J. The BCS of the HF×J was higher than that of either the HF or the J cows throughout lactation (Figure 3) and HV was estimated at 8%, higher than that observed between the NRF and HF breeds on the on-farm study. In terms of live weight, the HF cows were heaviest, averaging 525kg throughout lactation, compared to 390kg for the J cows. The HF×J averaged 478kg. This means a HV estimate for live weight of about 20kg or 4.5%, again larger than that observed with the HF×NRF cows.

Figure 3. Body condition score pre-calving, during the breeding season and prior to dry-off for the HF, HF×J and J second lactation cows at Ballydague.



Fertility Performance

The fertility performance for the second lactation cows from the Ballydague study is presented in Table 4. The breeding season began on the last week of April and ran for 13 weeks. All cows were bred by AI only. Tail paint was used throughout the breeding season as an aid to heat detection. Large differences in pregnancy rates were observed between the crossbred cows and that of both groups of pure bred cows. The pregnancy rate to first service observed with the HF×J cows was exceptional at 75%. By comparison that observed with the HF and J cows was poor at 38% and 39%, respectively. The six week in-calf rate of the crossbred cows was again superior at 76%, while that of the HF and J cows was 56% and 62%, respectively. The resultant empty rate after 13 weeks breeding for the HF, J and HF×J was 9%, 15% and 4%, respectively. Overall the reproductive performance of the three groups was such that the expected calving date for 2008 is expected to average March 15, March 04 and February 19 for the HF, J and HF×J, respectively. The survival rate from lactation one to lactation three for these cows is 50%, 79% and 90% for the HF, J and HF×J, respectively.

Table 4. Effect of breed group on reproductive efficiency during second lactation and survival from first to third lactation.

	HF	HF × J	J
Mean calving date 2007	Feb-25	Feb-18	Feb-24
Calving to 1st service interval (days)	76	74	73
Submission rate in the 24 days (%)	80	83	93
Pregnancy rate to 1st service (%)	38	75	39
Pregnancy rate after 6 weeks breeding (%)	56	76	62
Empty rate (13 weeks) (%)	9	4	15
Calving to conception interval (days)	104	86	94
Number of services per cow	2.34	1.42	2.19
Expected calving date 2008	Mar-15	Feb-19	Mar-04
Survival from 1st to 3rd lactation (%)	50	90	79

Genetic evaluations (EBI and hybrid vigor) for Norwegian Red and Jersey sires

The Irish Cattle Breeding Federation (ICBF) is the body responsible for the routine production and publication of all genetic evaluation data in Ireland. These evaluations are based on the performance of animals on commercial Irish dairy farms. A summary of the number of records and average EBI performance for Holstein, Friesian, Jersey and Norwegian Red AI sires from the ICBF national genetic evaluations is given in Table 5.

Table 5. Summary of EBI proofs for AI sires from Holstein, Friesian, Jersey and Norwegian Red Breeds.*

Breed	AI sires	Records	*EBI*	Milk	Fertility	Calving	Beef	Health
Holstein	1785	562426	**€16**	€24	-€8	€11	-€9	-€2
Friesian	208	72607	**€51**	-€2	€52	€13	-€11	-€1
Jersey	36	3318	**€58**	€30	€80	€11	-€61	-€3
Norwegian Red	14	1229	**€83**	€14	€53	€10	-€1	€7

**Based on sires born since January 1, 1988 (Nov 07 evaluations) with reliability above 40%*

Currently reliable EBI estimates are not available on all alternative breed sires. One of the biggest problems facing ICBF and across breed evaluations is the lack of data available for these breeds. For example, the number of AI sires (and daughters) evaluated for the Jersey breed is 36 AI sires and 3318 progeny, whilst the number for the Norwegian Red breed is 14 AI sires with 1229 progeny. Therefore when examining EBI values for these sires it is essential that reliability figures are consulted. Nevertheless, even with the small numbers available, the breed differences observed from National data are consistent with those established from research studies. For example, the superior fertility performance of the J and NRF breeds relative to the HF is readily observable from National data (Table 5). Furthermore, the positive attributes of the NRF breed for health traits, is also apparent, reflecting the importance that that these traits have played in the Norwegian breeding program.

Whilst the EBI provides farmers with factual information on the expected profit that an AI sire (or dam) will pass onto its progeny, it does not include the additional benefits of hybrid vigor. These should also be taken into account when making a breeding decision regarding choice of AI sires. Recent work completed by ICBF has suggested that the additional benefits of HV amounts to a minimum of €50 per lactation (see Table 6). Therefore, the total profit from crossing a Norwegian Red or Jersey with an EBI of €100, onto the average Holstein-Friesian cow, is expected to be €150 per lactation, i.e. €100 coming from the additive effects of the genes from the sire and a further €50 from the HV as a result of the cross. Whilst these initial trends are based on limited data, the direction and magnitude of the HV benefits are consistent with those from other studies, e.g. Jersey and Friesian crosses in New Zealand. It is also worth noting that the Holstein×Friesian crossbred will be the largest influence on the estimates provided in Table 6. Hence crosses between the Holstein and Jersey or between Holstein and Norwegian Red may vary from the estimates quoted. The estimate would very likely be larger. Evidence of this can be found in New Zealand where most studies show a higher HV estimate between Holstein and Jersey compared to Holstein and Friesian crosses. There is no data published reporting HV estimates on crosses of the Norwegian Red with other breeds. ICBF may also have enough data on crossbreds for a range of breeds to be able to evaluate the specific crosses between any two breeds. This would provide valuable information for the sire advice program, which could then factor HV into the calculation of overall merit of choosing a bull to mate with certain cows.

Table 6. Estimates of hybrid vigor for EBI traits

Trait	Economic value	0%	25%	50%	75%	100%
Milk (kg)	-€0.09	0	-4	57	77	93
F (kg)	€1.26	0	0	3	3	4
P (kg)	€6.91	0	0	2	3	3
CI	-€11.97	0	-0.6	-0.7	-0.8	-0.8
SURV	€11.17	0	-0.04	0.4	1.2	2.2
€ value		€0	€4	€24	€38	€51

ICBF are developing conversion equations for a number of breeds currently, most notably the Norwegian Red, Jersey and Normande breeds. Conversion equations use the principal whereby comparison is made between the performance of existing sires used in two countries and the comparison results are then used to predict performance of other sires being imported but having no daughters in the importing country. It is hoped that this work will be completed by February 2008, although the success of achieving this will once again be influenced by the quantity and quality of data connecting the various populations. This is an interim measure until there is enough performance data on these breeds to allow Ireland to enter INTERBULL evaluations for these breeds. INTERBULL evaluations should be the ultimate goal as they will allow the most accurate prediction of genetic merit of a bull tested in another country but available on an Irish scale similar to what is currently in place for the Holstein-Friesian (currently for milk traits, fertility, survival and SCC), and the Montbeliarde breeds (currently for milk traits).

Latest EBIs for cows on Norwegian Red and Jersey crossbreeding studies

The EBI and EBI sub-indices for the Norwegian Red crossbreeding study and Jersey study at Ballydague are presented in Tables 7 and 8, respectively. These are the most recent estimates available from ICBF (August 2007). However, there are a few points to note: i) as mentioned above, the across breed evaluation is still in its infancy and therefore the breeding values included for the Norwegian Red, Norwegian Red crossbreds, the Jersey and Jersey crossbred cows have low reliability. As the amount of data for these breeds and their crosses increases, and the across breed evaluation procedure is developed, the breeding values will become more certain; ii) the breeding values of the crossbred cows does not include the effect of HV. As indicated above this would be extra; iii) the EBI of the HF cows used as comparisons in both studies is not low.

Table 7. EBI and sub-indices for HF, NRF×HF and NRF cows on the on-farm crossbreeding study

	EBI	Milk	Fert	Calv	Beef	Health
HF	56	29	26	12	-9	-2
NRF × HF	62	18	37	9	-4	2
NRF	74	6	56	5	2	5

Table 8. EBI and sub-indices for HF, J×HF and J cows at Ballydague

	EBI	Milk	Fert	Calv	Beef	Health
HF	56	28	26	10	-8	-0.5
HF×J	82	46	54	14	-30	-1.5
J	62	27	86	10	-60	-1.8

Calving ease

The PTAs (breeding values) available for the Norwegian Red (typically -3 to -5) and Jersey (typically -5 or less) sires that have been used in Ireland to date indicate that the Norwegian Red as well as the Jersey breed are easy calving. Both breeds (at Moorepark and on the Norwegian Red on-farm crossbreeding study) have been used successfully on Holstein-Friesian heifers.

Where to after the first cross?

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

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

Whichever approach is favored, it is crucial that additive genetic progress is not neglected i.e. only the top bulls should be used.

Sire availability for 2008

Three Norwegian Red sires will be available through NCBC (i.e. Progressive Genetics/Munster) during 2008. These are Lekve (AI code LEV), Lier (no AI code yet) and Nøttestad (no AI code yet). These sires have been hand picked to ensure compatibility with the Irish production system. The Norwegian Breeding values of these three sires indicate that they are superior to many of the sires initially used to establish the Norwegian Red on-farm study. All three are recommended for use and are expected to be carried in the NCBC technician service flasks. The price of this semen is expected to cost €14 or €15 per straw.

A greater choice of Jersey sires is expected to be available during 2008 compared to the Norwegian Red breed. Jersey semen will be available from NCBC (Progressive Genetics/Munster) and Eurogene/New Zealand Genetics. The price of the Jersey semen available (non-sexed) varies from €14 to €25 depending on sire.

Both Norwegian Red and Jersey test bulls will be available this year as part of the GENE IRELAND program. Participation in the test program and use of these young sires is to be encouraged. The majority of these young test sires have been sourced from Irish herds from proven sires and dams.

Conclusion

Data has been presented from the second year of two research studies being carried out by Moorepark, the objective of which are to evaluate the potential of dairy crossbreeding for Irish dairy farmers. Both studies are expected to be continued for a further year. This is essential to capture differences that may arise in traits such as milk yield, fertility, health and survival as cows mature. The decision to crossbreed for many in the Irish context will likely be borne out of frustration of poor herd health/fertility or more recently due to the introduction of A+B-C payment schemes and a resulting desire to significantly increase milk value through improved milk composition. While an economic comparison for the studies has not been presented, considerable evidence is being accumulated from both studies to indicate that crossbreeding with the Norwegian Red or Jersey are real options for Irish dairy farmers in terms of improving herd profitability, in particular arising from improved reproductive efficiency. This is being obtained from a combination of additive genetic improvement and hybrid vigour. Differences in production expressed as 305d predicted values are likely to be different to actual yields delivered as differences arise between the breed groups in terms of 1) calving pattern, and 2) the proportion of cows surviving to develop into maturity. No different to straight breeding, only the best sires should be considered when crossbreeding. It is expected that in the near future accurate EBI values will be available for a greater selection of 'alternative breed' sires. This will be aided by the development of conversion proofs for new sires in the short term.

The ultimate aim for all Irish dairy farmers must be to generate cows that will maximise profitability in our system. Prejudices/mind set based on issues such as coat colour or what the neighbours might say must be cast aside. Think objectively, think profit!

Acknowledgements

The technical assistance of Noel Byrne, Ann Geoghegan, Billy Curtin and Tom Condon at Moorepark, as well as Sean Coughlan and Rachel Wood at ICBF is gratefully acknowledged. The commitment and efforts of the farmers involved in the Norwegian Red crossbreeding study is to be commended. Milk recording is being provided free of charge for the experimental cows on the Norwegian Red crossbreeding study. This support, provided by Progressive Genetics, Dairygold, South Western Services and ICBF is very much appreciated.

Profit from grass – a dairy farmers perspective

Michael and Shirley Bateman
Crookstown, Co Cork

Introduction

This paper deals with two main areas;

- The development of a farm from a green field site,
- Grass budgeting as a management tool.

Farm development

The home farm (Crookstown farm) comprised a total of 51.3ha, where the main enterprise was heifer rearing and silage making. In spring of 2005, the opportunity of a long-term lease (10 years +) of a further 37.6ha became available. This land had been in continuous tillage for 50 years.

As milk quota was restricted, a Milk Production Partnership (MPP) was entered into, which provided access to quota. Total farm size comprised 89ha, milking 200+ cows to fill a quota of 1,135,000 litres. There was little infrastructure on the farm.

The programme for farm development was as follows:

April 2005

- Reseed 40ha

Summer 2005

- Install low cost 28-unit parlour with handling facilities;
- Fence and lay out paddocks;
- Put water on the whole farm;
- Lay 3km of roadway.
- Sort paperwork for the Milk Production Partnership (MPP).

September 2005

- Move 75 cows + 45 replacements from the home farm;
- Combine above with 81 cows from the MPP farm.

2006

- Built silage pit for 1500t.

August 2006

- Install three cattle underpasses (the value of which cannot be under estimated in terms of time, labour and safety).

2007

- Install a new bulk tank,
- Reseed 16ha,
- Built a wintering pad for 250 cows which had been out wintered on crops the previous 2 years.

There are positives and negatives to developing a farm. It is a big move into unknown territory, and requires intense focus on the how and why of what is going on - in the long term spending significant amounts of money on development, and in the short term generating cash flow which is equally important.

The reward is the evident farm potential, still not fully realised. An added bonus has been milk price, which has been very welcome.

Negatives factors to consider was the mixing of the two herds, which led to serious herd health issues with an outbreak of IBR in February 2006 (eight cows were lost and milk yield did not pass 3.5 gallons for the month). Due to lack of organic matter because of 50 years in tillage, the tillage land under performed, with an estimated loss of 17% last year and 30% the previous year.

Red tape can be a further obstacle, e.g. in seeking planning permission for underpasses; delays were encountered because one council official was concerned about the public not being able to see cows on the road!

Grass budgeting

Grass is the cheapest form of feed, and to take full advantage of this resource, grass budgeting is necessary. This means matching supply with demand to maximise the growth of high quality grass. It also means putting as much as possible of this high quality feed through the cow in the form of grazed grass.

Grass budgeting: - what it is not!

A common occurrence at group meetings where grass budgeting is being discussed, amounts to 10 people standing in a paddock hotly debating whether there is 500, 700 or 1000kg of a cover in the paddock. This is not budgeting - get a set of clippers and scales and measure the grass.

The debate should be on;

- Overall farm cover,
- How it compares to where you had planned to be,
- What decisions need to be made to keep the plan on track?
- Is the overall plan correct or should it be reviewed?

The objective of grass budgeting is to create a wedge of grass so that there is a continuous supply of top quality grass for the cows. This is achieved by:

- having a plan for the year, with specific targets for different times of the year,

- doing a weekly farm cover,
- making grassland management decisions based on the information gleaned (farm cover, targets and current growing conditions).

It is also important to act on the decisions, to review them, work out why they work and why they don't work. As a member of the Grazing Musketeers, Gary Nolan is on the farm once a fortnight to help with the grassland management decisions.

Targets and practices

Autumn - keep to a 21-day rotation until August 20-23. This results in excellent grass quality, with green leaf down to the base of the sward leading to better utilization, which in turn leads to a good clean out in the last two rounds.

Rotation length is boosted by 2nd cut after-grass (cut around July 25), which is grazed in early September with an available cover of 2200kg. This is a high cover but of excellent quality. Utilization is superb, which adds 8-10 days to the round and boosts growth rates. The farm has a target 'Farm Cover' of 925 - 950kg at the start of September, increasing to a maximum of 1150kg of cover on September 20. These targets are critical to having enough grass for the autumn. Do not allow covers to get too high at this stage, as utilization will be poor, leading to poor quality and reduced growth. Closing from October 10 (when pre-grazing is below 2000kg) results in well-cleaned swards. Concentrates should be introduced mid October to make grass last to early December. Avoid damaging swards at all costs as this reduces total grass grown on the farm especially over the winter.

The last target for the autumn is to close 60% of the farm in the first 30 days, this ensures early grass for the spring.

Spring – an opening cover of 720kg DM/ha is required. A total of 25% of the farm should be grazed in February, with the first round finished on April 4. This 25% is to be grazed in the first seven days of the second round. The 75% left to graze is allocated on an area basis in March, with farm cover not allowed to drop below 450kg until the start of April. Graze to 3.5cm. Again, no poaching; cows will graze for 3 hours and stand off without silage as necessary (even if this means going for cows late at night or letting them out at 4am in the morning when the rain has cleared).

Even in tough springs, stock go full time to grass from February 1, using the above strategies. Several paddock entrances are used, as is the driest ground rather than the highest covers (on one occasion cows were allowed access to a 15ac paddock with a cover of 300kg just to get the 6 - 7kg of grass).

The fertilizer programme for the spring comprises a blanket spread of 50kg of CAN spread in mid January, and again in mid February with a bag of CAN after the cows graze. This results in 85 units spread by the start of April.

Grass allocation in spring will be 12kg for the first week after calving, rising by one kg a week, for each week to 18 kg after six weeks. A simple computer programme allows for calculation of the day's allocation on any given day.

Meal feeding

Meals fed are 5kg/cow in February and 3kg/cow in early March. Once the grass budget allows, meals are eliminated. This works well as it keeps demand low in February when grass growth is low, and when demand increases, is in line with grass growth. The intention is that this will improve peak production as cows will be on a good diet of grass and ration in February. The aim is to feed about 170kg in the spring with a further 150 -180kg in the autumn.

Another target is that the second rotation would take 21days (the first paddock in the third round will be grazed around April 26). The target for the main grazing season is to have a pre-grazing cover of 1500kg. When covers go over this, paddocks should be taken out quickly. Demand is set at 72kg mid-season. Stocking rate of 4.25cows/ha and offering 17kg per cow.

One of the benefits of a weekly farm walk is to identify problems on the farm, e.g. if a particular paddock is growing poorly, it might be grazed straight away, fertilized and got growing again.

Figures achieved on the farm to date

- 95% of the milk produced in 2007 came from grazed grass with no silage in the diet. Some concentrates were fed in the spring to dry cows but the milking cows ate only 220kg for the year, stocked at 2.75 cows/ha.
- Total concentrate in 2007 was down by 150t or €30,000 on 2006.
- Common profit for 2007 - 21c/l.
- Calculated grass grown = 13.75t, with tillage ground still 17% behind.
- Milk solids produced (per hectare) on the cow ground = 1052kg.

Targets set for the farm

- Move to Jersey cross cows, as genetics on the farm are less than desirable.
- Improved paddocks grew over 16t last year. The aim is to move the farm average to this figure.
- To graze 80% of the grass produced on the farm.
- Produce 1350kg milk solids per hectare on the milking platform within five years. This will be done with crossbred cows milking 450kg milk solids, stocked at 3 cows per hectare, and feeding less than 350kg of meal. To achieve these targets compact calving is essential, i.e. 90% in 6 weeks.

Summary

With regard to farm development, it was well worth taking the risks involved. As regards grass budgeting, it is necessary to; -

- Set targets and having a plan 'specific' for the farm.
- Walk the farm on a weekly basis to determine farm cover.
- Base grassland management decisions on the information gathered - *farm cover versus the plan*.

Grass is the key to profitability.

Competing on a world stage - lessons for Ireland

Pat Dillon, Laurence Shalloo and Brendan Horan
Teagasc, Moorepark Dairy Production Research Centre, Fermoy, Co Cork

Summary

- Allowing for increase in land and labour productivity, seasonal grass based dairy farming in Ireland can be the most competitive within the EU. Ireland is well placed to increase its share of European milk production if EU milk quotas were abolished.

- The short to medium term outlook for international dairy product prices are good (however with much greater volatility) driven by strong international demand, continuing decrease in EU exports, slower expansion in world wide production and historically low stock levels.

- Significant potential exists on Irish dairy farms to increase technical efficiency as indicated by financial performance being achieved on the average Irish dairy farm compared to that on dairy farms applying good technology.

- On the majority of Irish dairy farms considerable capacity exits within the milking platform to increase milk production using existing resources. This will be achieved by dedicating the milking platform to grazing dairy cows only and increasing stocking rate.

- The rate of increase in the scale of milk production on Irish dairy farms has been significantly slowed by the application of the EU milk quota regime when compared to our main competitor's worldwide. This continues to reduce the development of the Irish dairy industry.

- At farm level significant increases in milk output can be achieved from grazed grass through greater grass utilisation by increasing stocking rate, applying modern grazing management technology and using grass-based dairy cow genetics. Similarly there will be a requirement for increase supply of high EBI dairy replacements and earlier more compact calving.

- At processing level there is a requirement for increased efficiency in the production of commodity products while at the same time a shift to increase production of value added type dairy products.

Introduction

'Change will occur whether or not we plan for it. The question is whether we will have the foresight to embrace change and shape it to our benefit, or whether we will allow ourselves to become its victims.'
Agriculture Task Force
Chicago Council on Global Affairs
September 2006

Over the last fifteen years the Irish economy has been transformed from a country of sluggish economic growth, high unemployment and serious fiscal imbalances into an economy which today has the lowest unemployment rate, sustained economic growth and among the strongest fiscal situations in the EU. Between 1990 and 2000 GDP growth averaged 7.4% per annum, and 6.2% per annum since 2000 driven by EU membership, historically low interest rates and considerable foreign direct investment. Against the backdrop of frenetic economic progress, agriculture has remained an important indigenous industry making a high value add contribution to economic activity (2.5% GDP or 3.5% of GNP; CSO, 2006; 9.1% of total merchandise exports; Bord Bia) of which dairy production contributes approximately 35% of total output. Irish agriculture currently employs approximately 5% of the Irish labour force (CSO, 2007). In 2006 farmers purchased inputs and services worth €3.6 billion and earned approximately €2.4 billion most of which is spent within the local economy. The Irish dairy industry makes a major contribution to the Irish economy employing approximately 22,000 dairy farmers, 9.000 employees in the processing industry and supporting an additional 4,500 in ancillary services. Approximately 85% of Irish dairy products (valued at €2.1 billion), are exported annually which represents a quarter of all food exports.

While economic growth in the overall economy has slowed in recent years (estimated to be 3% in 2008), due to a relative loss of cost competitiveness and an over reliance on construction and the public sector, the outlook for dairy production has improved dramatically. Recent analysis carried out within EU has suggested that milk quotas are now constraining the development of an efficient European dairy industry (van Berkum and Helming, 2006) and policy proposals have now been initiated to remove EU milk quotas by 2015. In a EU context, Ireland has a comparative advantage over other countries in the production of milk because of our temperate grass growing climate and lower costs of milk production (Boyle *et al.*, 2002). A recent study by Lips and Rieder (2005) projected that quota abolition would allow production to move to areas of competitive advantage such as Denmark, Ireland and the Netherlands, predicting that milk production in Ireland could increase by up to 39%.

In Ireland pasture based dairy farming is the most profitable enterprise when based on the efficient conversion of grazed grass into milk. Allowing for increases in land and labour productivity, dairy farming in Ireland can be the most competitive within the EU. Greater globalisation of agriculture trade will create competitive challenges but also create unprecedented opportunities for efficient producers to increase production. In the past European farmers were unable to compete and prosper against farmers in other parts of the world if such changes in dairy policy were implemented because of less favourable climatic conditions, higher land and labour costs and smaller scale of operation. However, now it could be postulated that world prices for dairy products will be much higher in future given that growth in world demand for milk increasing by 2% more than supply. In the past this imbalance was redressed when farmers brought uncultivated land back into production however this may not now occur as: (1) world food demand could double by 2050 through a 50% increase in world population - all in developing countries and a 50% increase from broad-based economic growth in low income countries (mainly China and India); (2) threats to oil supply because of political instability and world reserves, are stimulating investment in renewable energy crops, which is diverting land from food production; (3) there are signs that climatic change is having a significant effect on agricultural production in many parts of the world with water becoming the greatest constraint.

Irish milk production has been controlled by milk quotas since the early 1980's; however the Commissions preferred option now is to end quotas on April 1, 2015. Similar agricultural reforms have occurred in many other countries. The deregulation of the Australian industry began in 1999 and has resulted in a reduction in dairy farm numbers with international prices now determining the price received by farmers for their milk. In New Zealand, the subsidy system was removed in 1984 and stimulated an expansion in production with increases in cow numbers and land conversions from other enterprises to dairying, reductions in input costs, increases in productivity as farmers reduced expenditure and redistributed resources to areas of comparative advantage (Philpott, 1995).

The objective of this paper is to i) describe the current situation of the Irish dairy industry via its competitors as an exporter of dairy products, in a scenario of increasing world demand and changing EU and international trade polices; ii) to describe the necessary changes required to ensure Irelands competitive advantage can be further enhanced in future; and iii) outline a vision for the Irish industry to 2015.

SWOT analysis of the Irish dairy industry

Ireland has a long and successful tradition as a major producer of quality dairy products. The grass-based production system has provided significant competitive advantage in term of production costs and the naturalness of Irish dairy produce. Policy changes arising from CAP reform and WTO agreements will push EU milk prices close to world market levels. World market prices for dairy products at present are at an all time high, but past trends show considerable volatility in milk price. These policy changes should act as an important stimulus to the industry to make the necessary changes to develop and become stronger into the future. To do this we need to carry out a SWOT analysis of the dairy industry to identify strengths, weakness, opportunities and threats for the industry going forward.

Strengths

- Ireland has enjoyed a competitive advantage within the EU due to its low cost grass based seasonal calving system. Grazed grass is the lowest cost feed available and in Ireland can make up a large proportion of the lactating cow diet (> 90%) over a 10-month grazing season. For climatic reasons most regions in the EU have a much shorter grazing season (six months) which increases the requirement for both concentrate supplementation and conserved forages as part of the feeding systems.

- The grass-based system also provides a competitive advantage in terms of naturalness of Irish dairy produce. This will allow Irish dairy industry to develop a product portfolio that capitalises on the values that are uniquely Irish. The increasing value-added content of the infant formula sector which is a major purchaser of dairy products is of huge strategic importance to the future.

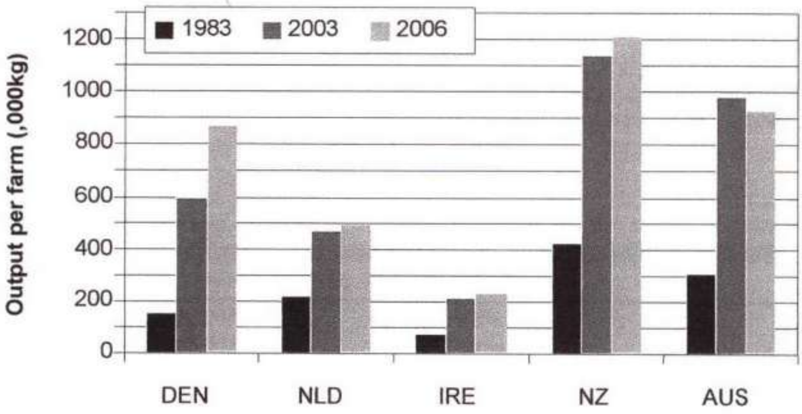
- Ireland has developed a strong technology base for grass-based systems in terms of grazing management, grass based genetics, reproductive technologies, labour efficiency and low fixed cost structures. Ireland has strong research, advisory and education structures that support these technologies.

- Ireland has a long and successful tradition as a major producer of high quality dairy products. In the Irish dairy industry at present there are approximately 22,000 dairy farmers with large potential to expand milk production in a no EU milk quota scenario.

Weaknesses

- The rate of increase in scale of milk production per farm in Ireland has been significantly lower than that of our main competitors in both EU (Denmark and Holland) and worldwide (New Zealand, Australia and US) since EU milk quotas were introduced in 1984 (Figure 1). From 1983 to 2006 milk production per farm (kg) increased from 150,000 to 864,140 in Demark; 220,000 to 493,116 in Holland; 423,000 to 1,211,746 in New Zealand, and 309,000 to 929,235 in Australia. This contrasts with 74,000 to 229,925 in Ireland over the same period. In terms of scale of milk production Ireland is much smaller than our main competitor's worldwide.

Figure 1. Developments in milk output per farm 1983 to 2003



- Rationalisation at processor level is required to achieve the scale and cost competitiveness necessary to successfully compete for international business. At present six companies process 80% of the Irish milk pool; while the corresponding number in Denmark, Netherlands and New Zealand are 1, 2 and 1 respectively.

- The Irish dairy industry produces a high proportion of its output in the form of commodity type products (butter, powder and bulk cheese). These products attract lower margins and are more sensitive to world market price fluctuations. The proportion of Irish milk utilised for butter production has only reduced by 6% over the last 27 years (70% in 1978 to 64% in 2005); compared to a 35% reduction in Denmark and 20% in Holland over the period 1991 to 2001. The only noticeable change in the product portfolio in Ireland has been an increase in the production of cheese from 13% in 1978 to 22% in 2006.

<u>Opportunities</u>

- Present forecasts are that world demand for dairy products is increasing by approximately 2.8% per year, while projected world growth rate is 1.75% per year. Since 2004 the growth in world demand for milk is 2% above the growth in supply, with the vast majority of additional demand occurring in developing countries. Table 1 outlines the projected increase in milk consumption to the year 2020 (Delgado, 2005). It is estimated that the projected growth in consumption of milk will increase by 0.6% and 2.9% per annum in developed and developing countries respectively. Over the period, milk consumption in developing countries will increase by 152mt, while in developed countries increases will only be of the order of 18mt. It is projected that per capita consumption of dairy products will increase from 202 to 211kg in developed countries, compared with increases from 45 to 62kg in developing countries (over the period 2003 to 2020). China and India will contribute to the greatest increases. The large increase in developing countries is being fuelled by increases in population growth, urbanization and income growth. Asian markets accounted for 50% of the total growth in Irish dairy exports in 2007. Alongside the increase in demand for dairy products there will be a similar increase in demand for meat consumption.

Table 1. Projected world consumption of cows milk

	Projected growth (1997-2020), (%/annum)	Total consumption (million mt)			% of world total 2020
World		1997	2003	2020	
Developing	2.9	194	223	375	62
Developed	0.6	251	268	286	43
Total		445	491	661	

Delgado, 2005

Table 2 shows world milk production and consumption 2001 to 2005. Since 2004 the growth in world demand for milk is 2% above the growth in supply. Present forecasts are that world demand for dairy products are increasing by approximately 2.8% per year, while projected world growth rate is 1.75% per year (FAPRI 2007 World Agricultural Outlook). It is projected that milk production will increase by 6%, 2.9%, 3.3%, 2%, 1.2% and -0.2% per annum in China, India, Mercusor, Oceania, USA and EU respectively between 2006 and 2013.

Table 2. World milk production and consumption - balance sheet (m.t)

	2001	2002	2003	2004	2005	2006	2007
Production	585.7	602.5	614.3	620.2	634.0	645.0	655
Stock change	+0.5	+3.6	+0.0	-1.7	-2.7	-2.0	-0
Consumption	585.2	598.9	614.3	621.9	636.7	647.0	655

- FAPRI-Ireland analysis has shown that Irish milk supply could be increased by almost 60% using existing resources on dairy farms, which concur with Teagasc surveys carried out across Glanbia, Connacht Gold, Lakeland and Donegal showing that it was possible to increase milk output between 60 and 70%. Specialist's dairy farmers have the highest family farm income, and with only approximately 20% of the grassland area of the country used for dairying then there is huge potential for increased milk production nationally.

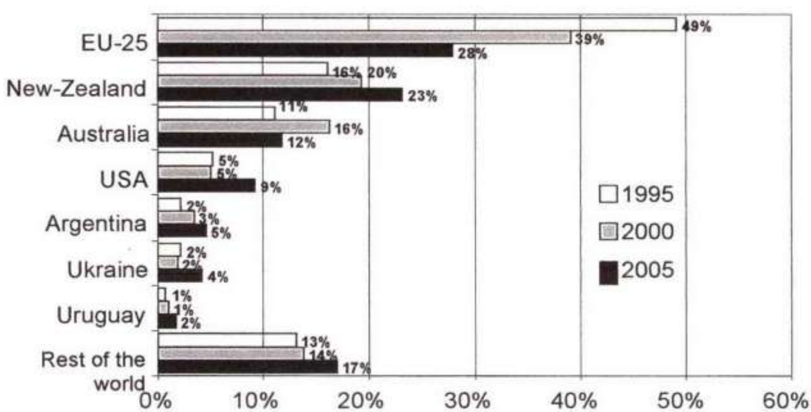
- Milk quotas have controlled Irish milk production since the early 1980's. However the Commissions preferred option now is to end quotas on April 1, 2015. Presently it could be postulated that EU milk quotas will be increased by 2% in 2008/09 and by a series of annual increases of 3% from 2008/09 to 2014/15 as part of the 'Health Check (totalling approximately 20% over the period). In this scenario FAPRI-Ireland analysis indicate that overall EU milk production would increase by only 3.7% by 2014 and milk price reduce by 7%. In this scenario Ireland would take up its full ~20% quota increase.

- Ireland being part of the EU-25 with a population of 456 million people is in a strong competitive position to increase its share as a provider of dairy products. This will be more important in a freer market scenario where milk production may decrease in many areas in Europe.

Threats

- The EU has been loosing its share of global dairy markets since EU milk quotas were introduced in 1984 (Figure 2). This has reduced the development of the Irish dairy industry since a large proportion of its dairy products are exported. If the EU adopts a conservative milk reform quota policy between now and 2015 then the Irish dairy industry would be most affected.

Figure 2. Shifts in world export market shares (1995-2005)



- Grass-based systems of milk production require access to large land blocks to permit expansion with land fragmentation likely to inhibit expansion for many Irish milk producers. Irish land purchase and rental prices are high driven by non-agricultural demand and prohibitive legislation. In other countries, land rental or purchase prices are much less restrictive and more financially feasible.

- A series of Directives have been introduced with the objective of protecting the natural environment, dealing with issues such as water quality, birds, habitats and the protection of the natural environment. It is important that not all grass based systems are set a legal limit of 170kg of organic nitrogen as set out in the Nitrate Directive and a derogation of up to 250kg of organic N/ha must be available to producers. Under the Kyoto protocol Ireland is committed to limit its increase in GHG emissions to 13% above 1990 levels between 2008 and 2012. In 2005, however, national GHG emissions were 23% above the Kyoto target; even though between 1999 and 2005 there was a 12% reduction in GHG emissions from agriculture due primarily to a decrease in livestock numbers.

Irish milk production efficiency

Milk production efficiency in Ireland is variable and low. Table 3 shows the evolution of input costs, gross outputs and margins from 1990 to 2006 for specialist dairy farms in Ireland. The results show that total input costs have increased by 2.4c/l over the 17-year period (1990 to 2006). Direct costs increased by 1.5c/l and overhead costs by 0.9c/l over the period. This resulted in a reduction in net margin over the 17 year period of 2.2c/l. Similarly over the period the cost/output ration increased by 0.08, indicating a reduction in competitiveness.

Table 3. Itemised costs, outputs and net margin (cent/litre) of milk production for specialist manufacturing milk herds 1990-2006

Year	Direct Costs	Overhead Costs	Total Costs	Gross Output	Net Margin	Cost / Output Ratio
1990	8.34	8.21	16.55	27.72	11.17	0.60
1991	8.09	7.93	16.02	25.60	9.58	0.63
1992	8.27	7.80	16.07	27.43	11.65	0.59
1993	8.87	8.23	17.10	29.80	12.70	0.57
1994	9.36	7.86	17.22	29.63	12.41	0.58
1995	9.87	8.50	18.37	31.02	12.65	0.59
1996	9.84	8.63	18.47	30.00	11.53	0.62
1997	8.62	8.20	16.82	28.50	11.67	0.59
1998	9.12	8.30	17.42	29.30	11.88	0.59
1999	9.08	8.22	17.30	27.85	10.56	0.62
2000	8.83	8.65	17.49	29.49	12.01	0.59
2001	9.11	8.76	17.88	30.73	12.85	0.58
2002	9.63	8.56	18.19	28.47	10.27	0.64
2003	9.16	8.13	17.29	28.05	10.76	0.62
2004	8.89	8.76	17.65	29.37	11.72	0.60
2005	10.18	8.71	18.88	28.19	9.30	0.67
2006	10.71	9.20	19.70	26.70	7.00	0.74

Source: Derived from National Farm Survey various years.

Table 4 shows the gross output, total input costs, and net margin (c/l) for the five cost quintiles and for the average specialist dairy farms in 2006. The total cost of production for the lowest quintile (20%) was 14.7c/l, compared to 26.4c/l for the highest quintile, or a difference of 11.7c/l; while the average cost of production was 19.7c/l. This difference in cost of production between the lowest and highest quintiles represents a difference of 11.4c/l (12.2c/l vs. 0.8c/l) in net margin; while the net margin of the average producer was 7.0c/l. Differences in feed costs (mainly concentrate costs) were responsible for 42% of the total cost difference. Of the overhead cost items – hired labour (8.4%), machinery operating and depreciation charges (11.8%), land rental charges (6.4%) and interest payments on loans (7.3%) were the major contributors to overall variation in unit input costs.

Table 4. Variation in unit costs (cent/litre) by quintile for specialist dairy farms in 2006 (population results)

Quintile	Q1	Q2	Q3	Q4	Q5	Average
Gross Output	26.8	26.6	26.5	26.4	27.2	26.7
Total Costs	14.7	17.5	19.4	21.6	26.4	19.7
Net Margin	12.2	9.1	7.1	4.8	0.8	7.0

Source: Derived from National Farm Survey 2007.

Table 5 shows a comparison of the physical and financial performance from the average specialist dairy farmer in the National Farm Survey (NFS), average from Fermoy DairyMIS Discussion Group (19 spring calving dairy herds) and the Moorepark Target.

Table 5. Comparison of the average farm from the National Farm Survey, Fermoy DairyMIS Discussion Group and the Moorepark Target for 2006

	NFS	DairyMIS	Moorepark Target
Milk yield (l/cow)	4,700	5,500	5,700
Fat (%)	3.75	4.03	4.20
Protein (%)	3.30	3.46	3.60
Milk solids (kg/cow)	342	412	445
Milk solids (kg/ha)	650	990	1,250
Concentrate (kg/cow)	713	480	300
Stocking rate (cows/ha)	1.9	2.4	2.80
Profit per hectare (€)	650	2,100	2,500

The performance of the average farm from the Fermoy DairyMIS discussion group was significantly higher in terms of milk yield per cow (800 litres), fat % (+0.28), protein % (+0.16), milk solids per cow (+70 kg), milk solids per hectare

(+340 kg), stocking rate (+0.5 cows/ha) and profit per hectare (€1,450); achieved with feeding 233kg less concentrates per cow. The performance of the farms on the DairyMIS Discussion Group was only €400 per hectare less than the Moorepark target. Therefore significant potential exists on the average Irish dairy farm to increase efficiency as indicated by that achieved on dairy farms applying good technology.

The competitive advantage of Irish milk production

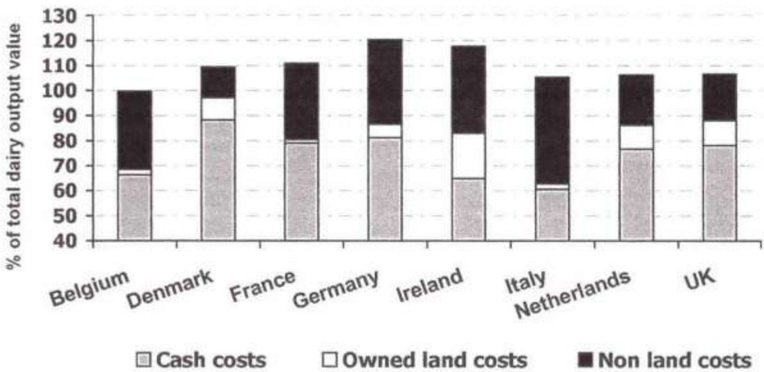
For the purpose of examining costs of production, costs were defined as:

(i) Total cash costs, which include all specific costs, directly incurred in the production of a given commodity, for example fertiliser, feedstuffs, seeds etc. plus external costs such as wages, rent and interest paid, plus depreciation charges.
(ii) Total economic costs, which includes all of the cash costs identified above, except interest charges, plus imputed resource costs for family labour, equity capital and owned land.

Figure 3 below shows total costs as % of dairy output for the eight year average, for each of the selected countries, for all specialist dairy farms in the European Commission's Farm Accountancy Data Network (FADN) (Thorne and Fingleton, 2005) sample. The value of dairy output was calculated as milk receipts plus dairy calf sales. Cash costs and the imputed charges for owned resources are identified. Cash costs as % of output were relatively low in Ireland over the period 1996 to 2003. Italy had the lowest cash costs as % of output at 61%, but the cost structure in Ireland and Belgium was only slightly higher at 65 and 66% respectively. The highest cash costs as % of output was experienced in Denmark where cash costs were 88% of total output of the enterprise.

The competitive advantage experienced by 'average' Irish producers worsens when all imputed charges for owned resources are taken into consideration. Ireland had the second highest total economic costs at 118% of output. The lowest total economic costs were experienced in Belgium, where nearly 1% of dairy output remained as profit for dairy producers on average over the eight year period. The main imputed cost that contributed to the relatively high total economic costs experienced in Ireland over the period was that for owned land. This was due to the relatively high imputed rental charge coupled with high levels of land ownership in Irish dairy production. The relatively low stocking rates and milk yields per hectare on Irish dairy farms over the period also must be considered as a contributing factor. However, it is worthwhile to note that when the imputed land charge for owned resources is not taken into consideration the relative competitive position of Irish dairy farms remains strong, with Irish farms showing one of the lowest cost to output ratios for the period 1996 to 2003.

Figure 3. Cash and economic costs for all specialist dairy farms in selected EU countries (1996-2003)



When total economic costs were considered as % of output for specialist dairy farms in the 50-99 dairy cow size category, Irish producers ranked as the third lowest total economic cost producer relative to all countries examined. When the imputed charge for owned land is excluded from the analysis, the larger Irish producers appear as the lowest cost producer, with 14% of total output remaining to remunerate the opportunity cost of owned land.

While the cost and return indicators presented in Figures 3 above represent average performance over the period 1996 to 2003, it is also important to determine whether or not the competitive position of Irish dairy producers has shifted over this time period. Hence, a linear regression model was fitted to this data to observe trends within the data. For the average sample there was no apparent significant trend over the period, whereas with the sub sample of larger producers there was a significant improvement in cash and economic costs per product volume for Irish producers relative to the average. Cash costs improved at a rate of 2c/kg of milk solids/year, and economic costs at a rate of 3c/year relative to the average of all countries.

Exploiting the competitive advantage of Irish production systems

Future farm systems will take the form of above average farmers leveraging debt to finance expansion and backing their ability and farming skills to generate the cash returns necessary to service the debt and deliver a satisfactory rate of return on time and capital investment. The system must be sustainable in terms of staff, animals and the environment, allowing for a quality lifestyle and providing for sufficient time-off for all staff. The system must therefore be simple and flexible, allowing for increased operational scale to be achieved without requiring large amounts of additional labour. Future systems will require new industry targets for a non-quota environment with targets set with respect to profitability, productivity and labour efficiency (Table 6).

Table 6. Key performance indicators (KPI) for the Irish dairy industry

Indicators	Current average**	Target
Milk solids per ha (kg)	660	1,250
Labour (cows/LU)	44	100
Labour cost/ha (€)	1,700	750
Profit per ha* (€)	1,030	2,500
Margin per kg milk solids (€)	1.56	2.00

**KPI's based on milk price projection of 26c/l, **based on National farm survey data (NFS, 2006)*

In future, most of the costs of milk production will be directly associated with the area of land being farmed, the number of cows in the herd and the number of people employed. Therefore, consistently high cash surpluses will be generated by ensuring that high levels of milk production are achieved per hectare, per cow and per labour unit. Successful dairy farms will optimise output/ha and the profit margin per unit of output. Output per ha will in future be measured in kg milk solids (MS) i.e. kg of fat and protein, as that is what is required and paid for by the dairy processor with 1,250kg MS/ha a realistic target for an efficient grass based milk production system.

A key economic principle, irrelevant of enterprise, is to optimise economic performance by capturing maximum profit per unit of the most limiting factor of production. In the intermediate term, land will become the most limiting factor of production on most farms, hence profit per ha will be a key performance indicator of a successful dairy business with a realistic target of €2,500/ha based on a milk price of 26c/l. The second major variable determining profitability on a successful dairy farm will be margin per kg of milk solid (MS) produced. This is the margin available to pay for all of the unpaid resources employed, i.e. land, labour and capital. As MS yield per ha and per cow increase, initially there will be an increase in margin per kg MS because of a dilution in fixed costs and benefits in efficiency from scale. However, as MS output per ha approaches the optimum the margin will reduce due to a reducing proportion of the diet from grazed grass. A realistic target margin per kg of MS is approximately €2.00 where MS per ha is relatively high (>1,250kg). A higher target margin would be realistic at milk prices in excess of 26c/l or where input costs can be reduced further.

Five main areas of technical innovation have been identified which will be important for the sustainability of dairy farming in Ireland:

(1) Increase in scale and efficiency at farm level;
(2) Using high EBI genetics;

(3) Maximising utilisation and performance from grazed grass;
(4) Developing labour efficient systems of production;
(5) Developing low fixed costs systems that allow dairy farmers expand.

Increasing scale and efficiency at farm level

Dairy farmers have no option but to increase efficiency and scale of production if they are to maintain incomes in future years. Acquiring and applying newer skills and knowledge needed for more efficient milk production is essential. Through research, new technology can be developed which will allow dairy farmers to increase scale while at the same time reduce the unit cost of production. Table 7 shows the level of expansion in milk production across a range of countries between 1975 and 2005. Prior to the introduction of milk quotas in the EU, the Irish dairy industry achieved an average annual increase in overall milk productivity of 7.2% per year between 1975 and 1985. This compares favourably with the increase of 2.4, 1.9, -2.1, 1.5 and 1.8% per year for the US, New Zealand, Australia, South America and the World, respectively during the same period. Such productivity gain was achieved through scaling up of herd size, increased intensification of Irish dairy farms and technological development in terms of the production system during this period. In a post EU milk production environment, Irish dairy farmers must strive for similar productivity gains as were achieved during this pre milk quota period.

Table 7. Trends in world milk production (000, tonnes) 1975-2005

	US	NZ	AUST	SA	Ireland	World
1975	52,371	6,193	6,803	15,200	3,308	388,908
1980	58,241	6,313	5,394	17,378	4,556	429,849
1985	65,166	7,343	6,217	17,532	5,682	460,331
1990	67,260	7,311	6,448	22,208	5,269	472,110
1995	70,500	9,285	8,460	26,947	5,288	467,992
2000	76,294	12,014	11,183	36,600	5,161	485,595
2005	80,255	14,103	10,451	48,300	5,062	531,300

Using high EBI genetics

One of the main factors influencing farm profit now and into the future is the genetic make-up of the dairy herd, which will be critical to the profitability of any dairy enterprise. Overwhelming evidence shows that selection solely on production traits results in reduced herd health, fertility and welfare with an almost 1% reduction per year in calving rate to first service in Irish spring calving herds between 1990 and 2001 (Evans *et al.*, 2006). Reproductive performance affects the amount of milk produced per cow per day of herd life, breeding costs, rate of voluntary and involuntary culling, and the rate of genetic progress for traits of importance and consequently results in a reduction in the overall profitability of a dairy herd. In Ireland, the relative importance of fertility is higher because milk production is based to a large extent on seasonal pasture production systems and thus profitability is influenced by the ability to calve cows rapidly at the optimum time. The average mean calving date of

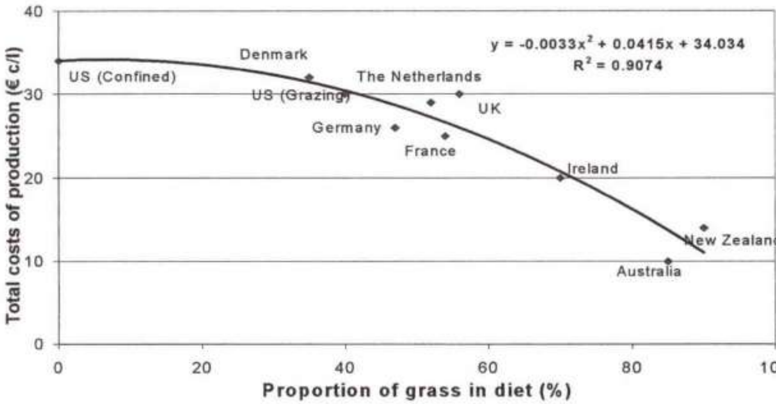
Irish spring-calving dairy cows is March 16 based on CMMS data (8 days later than 2002) with an average calving rate of 53% in 42 days (ICBF, 2006). This is considerably later than the optimum, which is mid-February with calving commencing in late January on a Moorepark type soil.

The EBI identifies sires whose progeny have a long herd life, annually producing a large quantity of high composition milk within a 365-day calving interval, are easy calving and have progeny who themselves calve easily in the future and exhibit large carcase weights of good conformation. In 2006, approximately 35% of replacements entering Irish dairy herds will have originated from AI sires, with the remainder resulting from the use of stock bulls (Department of Agriculture and Food, 2005). The average EBI of dairy cows and stock bulls recorded in Ireland is €24 and €8, respectively, with the average EBI of the dairy cow population only increasing by €1 per annum (ICBF, 2005). Based on the gains observed in research and the prevailing EBI in the national dairy cow population (EBI = €24), an increase in profit of €3,500 per 454,000 litres (100,000 gallons) of milk quota per year through the development of a high EBI herd can be expected in the coming years.

Maximising utilisation of grazed grass

One of the major competitive advantages that Ireland has over most EU countries is the potential production of between 12 to 16t DM/hectare over a long growing season from pasture. It is envisaged that the cost of grass silage will continue to increase due mainly to increases in contractor charges associated with inflation in labour, energy and machinery costs. In recent years grazing management strategies have been identified that increase the proportion of grazed grass and reduce the dependency on grass silage in Irish systems of milk production. Lengthening the grazing season by 27 days has been shown to reduce the cost of milk production by 1c/l. Continued technical innovation in grazing management will further reduce the cost of milk production and therefore ensure the viability of the dairy industry as a whole. Figure 3 shows a strong relationship between total costs of production and proportion of grass in the cow's diet in a number of countries (Dillon *et al.*, 2005). The data also show that increasing the proportion of grazed grass in a system that already entails a high proportion of grazed grass (UK and Ireland) will have a greater benefit in reducing the cost of milk production than a country that already has a low proportion (Denmark and US). The relationship shows that on average, the cost of milk production is reduced by lc/l for a 2.5% increase in grazed grass in the cow's diet. The level of grass utilization on the average Irish dairy farms is relatively and can be increased significantly through increased stocking rate and applying modern grazing management technology.

Figure 3. Relationship between total costs of production and proportion of grazed grass in cow's diet



Developing labour efficient systems of milk production

Table 8 shows the relationship between herd size and labour efficiency in Irish dairy herds.

Table 8. The relationship between herd size and labour efficiency in Irish dairy herds

	Small	*Medium*	*Large*
No. of cows	44	62	147
Milk quota (litres)	236,000	296,000	745,000
Hours/cow/year	49	42	29
Milking as a % of total time	35	32	30
Full labour costs (c/l)	10.2	9.7	6.4
Labour as a % of total costs	35	31	24

(O'Donovan et al., 2006)

In New Zealand the average number of hours labour per cow per year is less than 20, which is much less that that in the larger size group in Ireland. The availability of skilled labour capable of managing high performing dairy herds will also be a limitation in future and therefore dairy farms must adequately remunerate this skilled labour to compete with other sectors of the economy in sourcing and retaining staff. To achieve a high level of labour remuneration, a high output per labour unit is essential. A realistic target labour efficiency should be 22 hours per cow per year (O'Donovan *et al.*, 2007) thereby allowing one operator to manage 100 cows. The overall labour cost target should therefore be €900 per hectare with an average labour cost of €15/hr worked for both skilled and unskilled labour. The realisation of labour performance targets will depend on the simplicity of the overall system and the introduction of new technologies to reduce labour input.

<u>Developing low fixed costs systems that allow dairy farmers expand</u>
If dairy farmers are facing into a situation where milk quotas are liberalised but lower milk prices apply, then low cost expansion will be the key to the future profitability of dairy farmers in Ireland. To allow for expansion, extra housing and milking facilities will be required on dairy farms. The capital cost of conventional housing systems for a 100 cow herd is estimated at €250,000 as compared to €60,000 for an out wintering pad plus an earth bank tank (no grants included) to contain all slurry plus soiled water. When both systems are financed with a 15-year bank term loan with interest rate fixed at 7.3% the difference in annual costs (interest plus depreciation costs) is 2c/l. 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. Therefore with pressure to reduce costs and the absence of grant-aid for larger farms it is opportune to examine alternative lower cost systems. Recent innovations in using out-wintering pads and earth bank tanks have shown huge potential as alternative reduced housing and effluent management facilities for dairy cows.

The potential for expansion on Irish dairy farms

A survey was carried on over 1,430 dairy farmers supplying Glanbia, Connacht Gold, Lakeland and Donegal throughout 2007. The Glanbia survey was carried out in January and February while Connacht Gold, Lakeland and Donegal surveys were carried out from July to October. There were four objectives to the survey;

1. Determine the potential for expansion on dairy farms based on land areas around the milking platform as well as including other land parcels;
2. Determine the current labour availability and potential for a successor;
3. Determine the current status of milking and winter housing facilities;
4. Determine the future intentions of respondents.

Table 9 shows some of the biological and attitudinal responses to the survey. Average milk quota size and area around the grazing platform were larger for the Glanbia suppliers when compared to the combination of Connacht Gold, Lakeland Dairies and Donegal Co-op suppliers. Stocking rates were similar, and on average low for the two groups at 1.78 and 1.79 cows/ha. Milk production per cow and per hectare was also similar in the two regions. The number of suppliers planning to expand was similar at 50% with slightly more stating that they planned to exit in the Glanbia region (however this may be due to Glanbia suppliers being surveyed earlier in the year when milk prices were lower). When the total increase in output from the expanding farms is calculated and adjusted for those planning to exit, total milk supply, based on the surveyed farmers' intentions would increase by 9% for Glanbia and 14% for Connacht Gold/Donegal/Lakeland.

As indicated in the survey and based on best practice technologies, it can be anticipated that significant increases in dairy cow numbers could be accommodated on the existing land base with further increases in productivity achievable through improved animal genetics, compact calving, lengthened lactations and the provision of increased quantities of higher quality feed. When the potential expansion in production based on the current land areas of surveyed farms incorporating an optimum stocking rate and level of milk production in a no-quota scenario (2.7LU/ha and 15,000l/ha, respectively) is quantified and accounting for those planning to exit milk production, the potential increase in milk supply to these processors could be up to 60 – 70% on the surveyed farms.

Table 9. Survey of 1,430 regionally distributed dairy farmers across four milk processors carried out during 2007

	Glanbia	Connacht Gold/Donegal/Lakeland
Quota size (000, litres)	305,503	247,283
Grazing Platform Area (ha)	38.9	30.5
Stocking Rate (LU/ha)	1.78	1.79
Milking cows (No.)	64.6	52.7
Dairy specialisation (%)	0.63	0.70
Milk production (kg/cow)	4,808	5,194
(kg/ha)	8,346	9,212
Proportion expanding (%)	49	50
Proportion exiting (%)	14	9
Potential expansion (%)	70	60
Without successor (%)	25	29

Medium term outlook for milk production in Ireland (FAPRI analysis)

FAPRI-Ireland (Donnellan and Hennessy, 2007) has examined the effect of milk quota expansion on EU and Ireland milk production. Two scenarios were investigated; the first was a once off increase of 3% in EU milk quotas in 2008/09, and secondly as well as a once off 3% in 2008/09, a 3% increase each year between 2009/10 and 20014/15. These two scenarios were compared with quotas remaining in their present format between now and 2014/15.

A 3% increase in EU milk quota in 2008/09

A once off 3% increase in EU milk quotas in 2008/09 would result in a 2% increase in milk production at EU level by 2014/15. This increase in milk production would result in a reduction in milk price of 5% at EU level by 2015. Ireland would take up the full 3% increase in milk quota. Additionally Irish milk production would expand by 6% in the two years after milk quota elimination.

By 2016 the Irish milk price would be just under €25 per 100kg or 26 cent per litre. The price reduction that takes place in the last couple of years of the projection period is due to the expansion in EU milk production and reflects the fact that Irish milk production is still increasing by the end of the projection period. The lower milk price is offset by higher total production so that the value of the Irish milk sector is increased by 8% (€1,533m) relative to a continuation of the present quota system by 2016. If milk quota remain in place until 2015, it is projected that Irish milk price would be 12% higher in 2016.

A 3% increase in EU milk quota each year between 2008/09 and 2014/15

An increase by an additional 3% each year against the base 2008/09 would represent an increase in milk quotas of about 20% in advance of quota elimination. Across the EU only Ireland takes up the full increase in quota offered up to 2014/15. Over the projection period, the larger milk producing countries in the EU do not increase production in line with the quota increases. Overall EU milk production by 2014 would increases by just 4% and the average EU milk price would be 7% lower than if milk quotas remain in their present format. A key feature of this scenario is the negligible impact of quota removal in 2015, given that much of the EU in aggregate will have achieved its productive capacity in the quota expansion phase preceding the elimination. In other words, in this scenario the soft landing is achieved.

Little change in price or production occurs at aggregate EU level beyond 2009/10; as subsequent production increases in some member states tend to be offset by production contractions in others. As a consequence, when the milk quota is removed, aggregate EU milk production is more or less unchanged on the preceding couple of years. Accordingly, where quotas are increased by an annual 3% from 2009/10 to 2014/15, milk price changes relatively little between 2010 and 2016. Irish milk production continues to increase once quotas are removed, while milk prices at this point remain stable at approximately €25 per 100kg. In this scenario dairy cow numbers in Ireland in 2016, are up 2% on the 2006 level. Yields grow at a rate close to 2% per year, compared with just 1% per year presently. This additional rate of yield increase represents an extra 300kg of milk per cow by 2016 and is achieved through the exploitation of improved overall herd genetics, a modest increase in feed grain usage of the order of 100kg per head and a decrease in the amount of milk fed on farms.

Implications of milk quota expansion for dairy farm profitability and numbers

In line with milk price projections, net margins are projected to fall more rapidly in the two quota expansion scenarios. By 2010 net margin per litre on average cost farms is approximately 7 cent per litre if milk quotas remain as present, or just over 5 cent per litre if quotas are increased by 3% in 2008/09, and just less than 5 cent per litre if milk quotas are increased annually by 3% each year to 2015. The potential benefit of the quota expansion scenarios is the ability to increase milk production, albeit at a lower milk price than would be available under the current milk quota. Whether the net effect of producing more milk at lower prices is negative or positive depends on expansion costs.

If all existing creamery milk suppliers increase yields per cow by 10% and convert half of their beef livestock to dairy cows, then the national milk supply would increase by 50%. If we assume that the poorest performing one-third of farmers exit production, i.e. the high cost farms, and that the remaining two thirds follow a 3% expansion each year from 2008/09 to 2014/15, i.e. expansion within own resources, then national production would increase by 18%. This suggests that two-thirds of existing farmers may be able to fill the national increase in milk quota between 2008 and 2014 without any major expansion outside of existing farm resources.

The number of dairy farmers is projected to be lower in both milk quota expansion scenarios than if milk quotas remain in a 'no change situation'. A once off 3% increase in EU milk quota in 2008/09 is not sufficient to offset the milk price decline, however an annual 3% increase in the national milk quota would be sufficient to offset the negative effect on milk price, and farmers incomes would be higher than in a 'no policy change scenario'. Farmers locked into a high cost structure are worse under both milk quota expansion situations as margins are squeezed more than a no policy change scenario, profitable expansion is not possible. The extent to which individual farmers benefit under a quota expansion situation, depends on the availability of quota and its price in a no policy change situation.

Longer-term outlook for milk production in Ireland

In the longer term, faming enterprises that are most competitive will compete more favourably for limited resources such as land and labour, compared to less competitive farming enterprises. Dairy farming should have a competitive advantage over most other farming enterprises in most scenarios in Ireland. In the short term a significant proportion of the expansion in Irish milk production will come from organic growth on existing dairy farms and medium sized (80-120 cows) herds managed by family labour. Post 2014 the development of new green-field dairy operations from alternative enterprise conversions and rationalisation of existing dairy farms will become a reality. Teagasc must develop the technology for both incremental expansion as well as the development of large stand alone green-field developments of 300-500 cow dairy operations incorporating cutting edge research and good farm practice.

References

Boyle, G.E., Brown, S. and Reagan, K. (2002). 'The competitiveness of Irish agriculture'. *Irish Farmers Journal*, Dublin.

Connolly, L., Kinsella, A., Quinlan, G. and Moran, B. (2007). National farm survey 2006. Teagasc, Farm Surveys Department, Rural Economy Research Centre, Athenry, Galway.

Department of Agriculture and Food, (2006). *Annual Review and Outlook for Agriculture and Food 2005/2006.*

Delgado, C.L. (2005). Rising demand for meat and milk in developing countries: implication for grasslands-based livestock production. In: D.A. McGilloway (ed.), Grassland: a global resource. *Proceedings of the XXth International Grassland Congress*, Dublin, Ireland.

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

Donnellan, T. and Hennessy, T. (2007). The effect of milk quota 'expansion' on EU/Ireland production. *Teagasc National Dairy Conference 2007*. In: *Exploiting the freedom to milk*. Teagasc Oak Park Carlow 1-19.

Evans, R.D., Dillon, P., Buckley, F., Berry, D.P., Wallace, M., Ducrocq, V. and Garrick, D.J. (2006). Trends in milk production, fertility and survival of cows in 14 Irish dairy herds as a result of the introgression of Holstein-Friesian genes. *Animal Science (Submitted)*.

Irish Cattle Breeding Federation (2005). Irish cattle breeding statistics. *Irish Cattle Breeding Federation*, Shinagh House, Bandon, Co. Cork.

Lips, M. and Rieder, P. (2005). Abolition of raw milk quota in the European Union: a CGE analysis at the member country level. *Journal of Agricultural Economics*, **56**: 1-17.

National Farm Survey (Various Years). National Farm Survey Report. *Teagasc, Rural Economy Research Centre*, Galway.

O'Donovan, K. (2006). Labour efficiency on Irish dairy farms. PhD Thesis. *National University of Ireland*, Dublin.

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

Shalloo, L., O'Donnell, S. and Horan, B. (2007). Profitable dairying in an increased EU milk quota scenario. *Teagasc National Dairy Conference 2007*. In: *Exploiting the freedom to milk*. Teagasc Oak Park Carlow 20-44.

Thorne, F. and Fingleton, B. (2005). Irish dairying - can we compete? *Teagasc National Dairy Conference 2005*. In: *Winning in changing times*. Teagasc Oak Park Carlow 10-24.

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

Veerkamp, R.F., Dillon, P., Kelly, E., Cromie, A.R. and Groen, A.F. (2002). Dairy cattle breeding objectives combining yield, survival and calving interval for pasture-based systems in Ireland under different milk quota scenarios. *Livestock Production Science*, **76** 137-151.

Profitable grass based dairy farming in the UK

Chris and Debbie James
Stackpole Farm, Castlemartin, Pembroke, Wales

Key Messages

- Measurement is driving success. Young stock management has been greatly improved by weighing. Grass measurement and budgeting works even on large-scale farms. Financial measurement works on the same basis.
- Simplify the system – grass based only.
- Mixing with grass focused, positive people.
- Improving personnel skills (managing staff) - key to successful expansion when farming on a large scale.

Background

Mission Statement

To operate a simple pasture based system, with self-contained feed supply, but allowing for the strategic use of purchased feed. The system should focus on simplicity and low cost structure, with minimal capital input, whilst constantly improving the fertility of the land. This must lead to a highly profitable farm, operated at all times within the relevant farm assurance guidelines with particular attention paid to the welfare of the cow.

Each dairy should be managed by a team of motivated people undergoing extensive on and off farm training, with mutually favourable terms of employment to provide all with personal fulfillment.

Farm and herd statistics

Formally the farm was a mixed 'old English' farming enterprise, but is now a specialist, seasonal grass based dairy system operating along New Zealand principals. Information was accessed through the Grasshopper discussion group, founded by Paul Bird. In the UK, yield per cow is the key driver. There is little focus on low cost, high solids output, and grass based dairying. Irish dairy farmers are lucky to have a good independent research body and a Journal that is unbiased in its reporting.

A big issue for UK dairy farmers is that the processing industry is not farmer led, but rather is market led, consequently there is a big emphasis on producing milk (water) to meet requirements. Milk produced on the farm is sold to Saputo to make mozzarella cheese.

Land

Farm Size = 480ha in total, milking 1,100 cows in 2 herds.
Home Farm = 150ha; Quay Farm = 180ha; outlying farms = 150ha – 4 different blocks.

Stock

In May 2008 Home Farm will have 500 cows with a stocking rate of 3.5 cows/ha. On Quay Farm (which joins Home Farm), cow numbers = 600. There will also be 360 weanlings (0 to 1 year old) and 360 (approx) heifer calves.

Weather data

Rainfall is approximately 1100mm. As the farm is on the coast, it is exposed to harsh winds but has little exposure to frost. Salt damage is not an issue. On average 5kg to 10kg of grass is grown over the winter months, especially during mild spells of South Westerly weather. Soil temperatures tend not to drop below 5 degrees until early December. With increasing day length after Feb 1, grass starts to grow. The farm is almost at sea level, with high banks rising to 120m.

The environment

Only 3% of the land in Wales is in a Nitrate Vulnerable Zone (NVZ). In comparison Ireland has gone down the 'whole Island' policy for the Nitrate directive. There is a proposal to change this policy, which would increase the NVZ area in Wales to 7% of the land area (including this farm). The UK also has a Nitrate Vulnerable Zone system, but 70% of the land in England is to be designated NVZ.

Background fertility

The original herd and farming system was based on a traditional autumn calving system, i.e. cows calved from Aug to March. Holstein Friesian, Dutch and American genetics were used (based on PIN figures – similar to EBI system). When the decision was made to change the production system, 120 of the August calvers were sold, with the later calvers being retained and held to calve the following spring. Shorthorn, Jersey and New Zealand Friesians were purchased when restocking.

Breeding management

Four weeks prior to breeding all cows are tail painted. Cows are observed weekly and any non-cycling are noted, and checked by the vet.

The day before breeding starts (20 April) the cows are repainted. All inseminations are done from observing the tail paint. This observation is done only at milking time. The tail paint is topped up two to three times per week. With a large herd, the experience is, reading the tail paint is easier than going to the paddock with notebooks etc. The AI is contracted out at a cost of £3 (€3.96) per cow.

Heifers are synchronised on the out farm. For ease of management the 350 heifers are divided into groups of 120 to 140. The 6 and 11 day PG routine is used. Heifers are inseminated with Jersey bulls only. Once served, the heifers run with Jersey crossbred or Jersey stock bulls. Conception rates to synchronisation are 60%+. Kamar heat strips are used rather than tail paint on the heifers.

Initially, Jersey semen was used (for 4 years) to escalate the move away from Holsteins. Currently the policy is to use New Zealand Black and White Friesians. The reason for this change is that there is a greater market for Friesian stock. High survivability black and white genetics like Hugo, Dawsons Belvedere, Koremeko, Etazon Bell are used. Dairy AI is used for 6 weeks, followed by beef AI for 3 weeks. After 9 weeks of AI, stock bulls run with cows until the end of July. 75% of the cows calve to dairy bulls. The current non-pregnant rate is 14%, after a 14-week breeding season ending 17th July. The hope is to improve on this. All cows are scanned in September. This allows identification of potential stock for sale. Empty, lame, high SCC cows are sold early.

Calf rearing

All bull calves are sold for export depending on the market.

Changes made to colostrum feeding have greatly improved calf mortality. The first milking after calving of mature cows (3 years old plus) is collected. These cows have been vaccinated with rotavirus. This 'colostrum' is routinely used to feed all newborn calves. Each calf is stomach tubed as a routine. The rest of the colostrum milk is collected into a separate bulk tank and yogurtised to store it, and fed to young calves (few days old).

Calves are taken from calving pens in mid morning and cows are milked in the afternoon. Mortality rates were high among heifer calves from heifers, but the more effect use of colostrum has transformed mortality rates.

Cows are calved on a stand off pad. The intention going forward is to use an empty silage clamp, filled with wood chip for calving also. Calves are sorted and brought to the rearing farm where they are stomach tubed with colostrum. Dehorning occurs (few hours old) at this stage also. Calves are reared in pens of 25 with a band around their neck. This is not removed until they are able to suck by themselves. For the first 2 weeks they are on *ad lib* milk where intake can be as high as 8 litres per calf. Once this target is met, milk is restricted which has the effect of increasing meal consumption from 1 to 2kg. Calves are fed for 6 weeks once a day on 4 litres/head. Meal is fed to calves until about May/June. Total meal fed is 50kg/calf. They get about 1kg/calf when at grass. They are grazed in rotation with the bulling heifers.

April heifer calves are sold. 350+ heifer calves are reared. Beef (Angus) calves (mainly bulls) averaged £110/head (€145) in 2007. Going forward Kale feeding of young stock will give some flexibility to rear 400 plus heifers.

Stock management

Calves are vaccinated for Blackleg only. Calves are weighed to determine time of weaning and batched accordingly. Weighing continues throughout the year. Lighter calves are batched for the first winter and fed a better ration indoors.

Coccidiosis has become an issue. Typically Decox powder is fed in the meal and animals are dosed with Vecoxan in July. The options of moving calves to cleaner pasture is also being looked at.

Originally when building, the herd we vaccinated for Leptospirosis, BVD and IBR. As the herd it now closed, Leptospirosis is the only vaccine used. To date, no ill effects have been observed from dropping IBR and BVD vaccines from the herd. One third of cows (mature from this herd -colostrum) are vaccinated for rotavirus. There is a routine TB test in April of all stock.

Herd production

Calving begins at the end of January and continues until end of April. On Home Farm no meals are fed until August. Feeding on the Quay farm is 1kg/cow/day in spring. The aim on Home Farm is to feed 300kg/cow. On Quay Farm drought can be an issue and meal feeding can be as high as 1t/cow but the intention is still for 300kg/cow. Each farm has a separate lame/antibiotic milk group. This becomes a once a day group before breeding.

2007 production

Home Farm 4400kg/cow; Quay Farm 5000kg/cow. On average Fat 4.6% and Protein 3.6%. For 2007, Quay Farm produced 410kg milk solids per cow, up from 360kg milk solids in 2006 (dry summer). Extra meal may be fed in autumn depending on milk price (30ppl = 40.9c/l) due to the seasonality scheme.

Labour

There are three staff on Quay Farm, and 2.5 staff on Home farm, plus a tractor driver who milks every second weekend. There is also another half person, a stock person, a working mother who arrives at 9.30am and leaves after 4/5 hours work in the calf shed. Staff get a day a week off when not on their weekend off (they get every other weekend off).

The business is run in partnership, with one partner (a brother) looking after the financial administration (VAT and accounts), whilst the author is responsible for movement records and day-to-day administration. The aim is to have 2 self managed dairies with separate teams. Staff are difficult to recruit. This year 2 Eastern European workers were employed for Quay Dairy and they rotate the milking. A nephew has also joined the business this year.

Cows are stripped once a week and 2 cows with clots on average are picked up. To control mastitis, teat spray is used with regular service of the milking machine.

Machinery/contractor

Silage making is contracted out. Surplus grass is removed every 3 to 4 weeks. Silage contractors charge £40/acre (€52.9) with mowing included. Slurry spreading (via umbilical hose) is also contracted out at a cost of £35/hour (€46). Kale is drilled (one pass) using a contractor. Contractors were also used to lay cow roadways.

Contracting fertiliser spreading was not successful, and as a result the business has invested in a tractor labour unit, who doubles as a maintenance man for hedges etc.

A Bobcat is used to scrape the yards and fill feeders. A small tractor is used to pull the wagon. At Quay Farm a tractor with front-end loader is used. Other machinery includes a 150 HP tractor (which works at fertiliser spreading, hedge trimming), a dump trailer and a post driver.

Winter feed

The indoor winter period is very short. Cows go out to grass as they calve in the spring and young stock go to grass in late January. Grass silage is fed indoors. Cows are estimated to eat 3t fresh weight/year, so 3000t of silage is needed for cows and young stock. Last year 150 cows were off wintered. This year the number is 300, costing £7/cow/week (€9.25). They are fed grass silage. The farm is 7 miles away and the cows walked over and back.

This year 12ha of Kale (Maris Kestrel) was sown in late May. Currently there are 160 weanling heifers and 140 incalf heifers on kale since early December. The weanlings will come off the kale in late January and go to grass. Youngstock are split on weight. The heavier/bigger weanlings are outside and the lighter/smaller heifers are in one group and receiving 3kg of meals, ½kg of straw and 2kg of silage. Last year maize gluten and straw was fed.

Facilities

There are 300 cubicles on Home Farm, with another 300 wooden cubicles available but only used in emergencies! Silage is fed in an easy feed system on raised feeding platforms. These sheds were built in 1963. Yards and passageways are scraped into an over ground steel tank. On Quay Farm there is a stand off pad (60m x 50m) with concrete slab and self feed grass silage. There are also 300 wooden cubicles with feed facilities for 150.

Milking parlour: A 40-point herringbone on Home Farm built in 2002 with a large circular collecting yard. On Quay Farm there is a 50-point rotary built in 2000. Both milking machines are basic with no frills.

Typical day in March/April

Cups on at 5.30 am to 8 am. Two milkers on Home Farm and two milkers on Quay Farm + relief during breeding etc.
Break 8 to 8.30 am then grass measurement. For grazing early spring we use a 12-hour and then out to 24-hour breaks. Stock health issues etc
Home for lunch 11.30 and back again at 2.30pm. Aim to have staff home for 5 pm.

It's a 10 hour day in the spring but is helped greatly by having all stock out of sheds by March 1.

Typical day in autumn

Dry Period - winter hours. One person at 7 am to scrape and they work until lunch. Another person on at 8 to feed and they work until 10 am. After this dosing and branding etc as required. Autumn hours are 6 hours per day.

Holidays – One week in summer and holiday periods. Once bulls go in the farm begins to look after itself.

Ownership structure

Originally the farm was a 7000-acre estate. This block was split up over a number of decades. Stackpole Home Farm (1100 acres) was owned by a pension fund after the original owner got into financial difficulty. Eventually this was offered to lease in 1980. The farm is now owned privately, but leased to the business partnership until the end of our days, at a cost of £100/acre (€132) rent.

There are 2 dwelling houses and 3 workers cottages. The lease includes a full repair and tenancy upkeep, so the business is responsible for all maintenance. There is a 10-year write off period on capital expenditure.

Outside blocks of land are all on 5 and 10 year FBT (Farm Business Tenancy - contract between tenant and land owner). This is a recent development as it was felt that leasing was too much stacked in favour of the tenant, with the owner not able to change lease. This has had the result of making rental land more fluid. FBT contracts were brought in to free up the land rental market, and have proved popular within the farming community.

Expanding in the UK

The cost of conversion from a mixed Old English' dairy farm to spring based dairy farming based on grass is estimated to be £600/cow (€792), (includes a 50-point rotary milking 600 cows, + roadways, water and fencing).

<u>Problems or issues related to expansion</u>

Sourcing quality stock. Not an issue - large groups of cows have been successful imported from Scotland and Ireland.
Quota - not an issue since 2001.

Labour. There is a concern that farming is not attracting the 'right' young people into the industry. The blame has to lie with parents and elders who still perceive farming as an unsuitable way of life, rather than a progressive business with potential.
Availability of large tracts of land in the UK. Large 150ha blocks are available in the South of the UK, but not in Wales. However, higher grain price is driving higher demand and price. There is little demand for chalky land, so there may be further opportunities with this type of land. A 300 cowherd is a good base to work from, and economies of scale can easily be achieved with a herd this size. It is suggested that a 90ha block could carry such a herd on a profitable grass based system.

To offset the cost of conversion several measures were taken:

- All sheep stock sold, 1000 breeding ewes at £100 (€132) each;
- All surplus machinery and equipment sold;
- Ceased to sow 200ha of cereals;
- Sold 120 autumn calvers plus calves;
- Leased back the farm quota not filled for 12 p/litre (€0.16c/litre). The shortfall in milk output was offset by the ability to lease out the quota.

At the time of converting the farm, approx. 3 million litres were sold off farm. Last year 4.8 million litres were sold. A 60% increase in milk output has been achieved. Land area has increased from 420 to 480 hectares.

The future

The challenge for the business is to hold costs at a low level. This means low cost housing, staying focused and holding a vision for the farm. A good discussion group helps. It challenges all aspects of farming and provides a benchmark against the best.

A current area of interest is 'Once A Day' milking, even at high milk price. When fertiliser was £100/ton (€132) it was not justifiable, but as price increases to £250/t (€330) for 25% nitrogen compound, it may offer some opportunities especially where stocking rates are tight.

For the last 5 years, common costs (excluding rent, drawings and quota cost) have been 12p/litre (€0.16c/litre). As pressure on feed and fertiliser costs increases it will be a struggle to keep costs at current levels. Several cost effective measures are being investigated, e.g. like out wintering stock, off wintering stock, clover leys and the use of higher fertility livestock. To reduce risk exposure to price increases, there is a need to maximise output, and this means better fertility and top class grassland management. In the short term there is the possibility of taking on another farm.

SWOT analysis of UK dairy farming

Strengths

Large UK population on doorstep;
High liquid milk consumption – milk with cornflakes
Strong milk fields in West of Country – guarantee production;
Ready supply of industrial by products - animal feeds;
Good road and rail infrastructure nationally;
Low political and currency risk.

Weaknesses

Little farmer control at processing level;
Very much price takers;
Little government support;
Labour – limited supply of skilled farm labour;
Pessimism among the dairy farmers;
Limited support services – not focused on grass;
Cash flows are not strong.

Opportunities

Availability of second grade arable land – large blocks;
Quota not limiting at farm level;
Tax – 100% write off on capital expenditure (sheds etc) from April 1 (may have a negative effect as plenty will build for no good reason);
Organic farming – offers possibilities;
Most production based around high cost systems.

Threats

Animal disease – Blue tongue (herd expansion issues);
Nitrate Vulnerable Zones (NVZ's) - limit stocking rate and increase cost;
Reduced availability of skilled labour in the future;
Milk price volatility;
Long-term industry ownership – not farmer (Co-op) based ownership like Ireland.

Profit from grass: a researchers' perspective

Deirdre Hennessy, Michael O'Donovan and Emer Kennedy
Teagasc, Moorepark Dairy Production Research Centre, Fermoy, Co. Cork

Key Points

1. In relative cost terms, first cut silage is 2.5 times more expensive than grazed grass, second cut silage is 2.9 and concentrates is 4.2. The cost difference between these feeds is likely to increase further in the years ahead.
2. Profitable milk production in Ireland must be based on the provision of sufficient quantities of high quality pasture to produce quality milk at lowest cost.
3. Cows should be turned out to grass immediately post calving to maximise the proportion of grazed grass in the diet of the dairy cow and maximise milk production from this low-cost feed.
4. Spring grazing management must focus on efficient use of grass to replace grass silage and concentrate in the lactating cow's diet.
5. The first rotation must last until mid-April, excessive pasture damage must be avoided and post grazing height must be maintained at 4-5 cm to ensure pasture quality is high during subsequent rotations.
6. 0.8 - 1.0t grass DM/cow consumed from turnout until the end of the first rotation should be achievable on farms practicing early spring grazing. Grazed grass and concentrate can be the sole feeds with such a system.
7. Spring grazing has a large carryover effect on grass quality in subsequent rotations through the conditioning of the sward.
8. Mid-season management must aim to maximise animal performance while maintaining pasture quality. High pre-grazing yields (>1800 kg DM/ha) should be avoided. Topping and silage conservation should be used as tools to correct poor pasture quality.

Introduction

Increased interest in the production and utilisation of grazed grass on dairy farms has been brought about by ongoing trade liberalisation and the probable phasing out of milk quotas, combined with increased costs of silage production, home grown cereal production and imported feedstuffs. Grazed grass is and will continue to be the cheapest feed available for milk production systems in Ireland. When compared to grazed grass, first cut silage, second cut silage and concentrates are more expensive by factors of 2.5, 2.8 and 4.0, respectively. Economic analysis (Shalloo *et al.*, 2004) shows that maximum profitability within Irish milk production systems can only be achieved through the optimum management of pasture both within the current quota regime and within future scenarios where additional quota may be available to Irish dairy farmers. Maximising the performance of their herds from grazed grass will be a critical factor in deciding the future business success of dairy farmers.

Regardless of country or quota existence, a 10% increase in the quantity of grazed grass in the feeding system will reduce the cost of milk produced by 2.5c/l (Dillon *et al.*, 2005). One strategy to increase our competitiveness irrespective of milk price is to continue to increase the grazed grass proportion of the diet. The main avenues through which this can be achieved are increased uptake of grassland management technologies, as well as extending the grazing season in early spring and late autumn. This paper focuses primarily on early spring grassland management.

Current grassland management advice

The grassland management practices in the Moorepark Blueprint System have evolved over the last 23 years (1984-2007), as shown in Table 1. More emphasis is now placed on technologies to extend the grazing season earlier into spring and later into autumn, to reduce the requirements for alternative higher cost feeds. Mean calving date has been delayed, and stocking rate has been reduced to facilitate the incorporation of a greater proportion of grazed grass in the diet of the dairy herd. The current grazing season length is 300 days, with the main increase in the number of grazing days achieved through early spring turnout. Sward grass growth potential has increased, primarily through reseeding of older pasture and through more efficient use of artificial and organic fertilizer. There has been a consistent reduction in the proportion of second cut grass silage taken, as the demand for grass silage has been substantially reduced as a result of a longer grazing season. Early turnout (post calving) is now normal practise on many farms with clear benefits in terms of animal production and sward quality (Dillon *et al.*, 2002; Kennedy *et al.*, 2005).

Table 1. Changes in the Moorepark Blueprint System for spring milk production between 1984 and 2007

	1984	2007	Difference
Mean calving date	2/2	24/2	+22 days
Stocking rate (LU/ha)	2.91	2.5	-0.41
N input (kg N/ha)	423	255	-168 kg
Grazing season length	250	300	+50 days
Turnout by day	10/3	10/2	+27 days
Turnout full time	1/4	10/2	+49 days
Housing date	15/11	25/11	+10 days
Silage area - First cut (%)	43	40	-3%
Silage area - Second cut (%)	33	15	-18%
Annual Dairy Cow Feed Budget			
Grass (t DM/ cow)	2.8	3.9	+1.1
Silage (t DM/ cow)	1.5	1.0	-0.5
Concentrate (t DM/ cow)	0.75	0.35	-0.4

Due to the extension of the grazing season the feed budget of the dairy cow has also changed over the past 23 years – grass allowance has increased by 40% coupled with a 30% decrease in grass silage input along with a 50% reduction in concentrate offered. In the future a further increase in the quantity of grass in the overall feed budget is likely (Table 1).

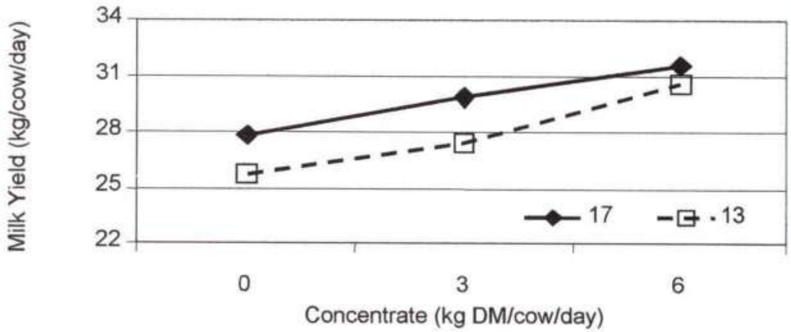
Provision of grass for early spring grazing

The date on which swards are closed in the autumn and the application of spring nitrogen (N) fertilizer are two of the most important management factors influencing the supply of grass in early spring. The date of initial spring N application depends largely on location and soil type. A response of 16kg DM/kg N applied in mid-January has been measured in early March at Moorepark, over three years. In the central part of Ireland the optimum date for initial spring N application is early/mid-February and in the northern region it is mid- to late February. The initial N fertiliser application should be 30kg N/ha, followed by a second application of 30 to 50kg N/ha. Autumn grass management is critical to ensure a suitable closing cover, which will provide sufficient grass for early spring turnout. Paddocks should be closed in the order in which they are to be grazed the following spring. Post-grazing sward heights should be in the region of 4 - 4.5cm (150 – 200kg DM/ha), thereby encouraging winter tillering and ensuring a productive sward for the following spring.

Herbage allowance in early lactation

Early spring grass is extremely digestible and high in crude protein, so its provision in the diet of dairy cows is essential if farms are to be profitable businesses. A series of experiments have been undertaken at Moorepark to establish the optimum level of herbage allowance and concentrate feeding level that should be offered during the first and second grazing rotations (early February to mid-May). In the course of these experiments cows were offered varying grass allowances (13 – 19kg DM/cow/day) in conjunction with differing concentrate levels (0 to 6kg DM/cow/day). From these investigations it is clear that a grass allowance of 15kg DM/cow/day should be allocated to spring calving dairy cows during the first grazing rotation. A high response to concentrate (on average 1.1kg milk/kg concentrate) was also achieved by the cows in early lactation. The positive effect on milk yield of supplementing cows with concentrate in the early lactation period persisted into mid-lactation and resulted in higher total lactation milk yields. Figure 1 synopsises the experiments undertaken to determine optimum herbage and concentrate allowances in early spring. From this graph it is clear that if farm cover at turnout is low then cows offered a low grass allowance (13kg DM/cow/day) and 3kg DM of concentrate will attain the same level of milk production as those offered 17kg DM/cow/day and no concentrate.

Figure 1. Effect of grass allowance level (13 or 17kg DM/cow/day) and concentrate level on the milk production of spring calving dairy cows



The recommendations for early spring are to turnout cows directly post calving and offer a grass allowance of 15kg DM/cow/day and 3kg DM concentrate during the first grazing rotation. By adhering to these principles the dual objectives of early spring grazing can be achieved, i.e. maximising the proportion of grazed grass in the diet of the dairy cow while simultaneously conditioning swards for subsequent grazing rotations. This essentially means obtaining a balance where cows are adequately fed yet paddocks are well grazed (to a post grazing height of approximately 4 - 4.5cm).

Animal performance benefits from an early turnout

The benefits of turning cows out to grass immediately after calving, have been demonstrated by Kennedy et al., (2005). The production performance of spring calving cows turned out to grass full time from calving in early February was compared with that of a group of cows that remained indoors until early April. The 'outdoor' cows were offered a daily grass allowance of 15kg DM and 3kg of concentrate, while the 'indoor' cows were offered a diet containing 40% grass silage (8.6kg DM/cow/day) and 60% concentrate (11.1kg DM/cow/day). There was no difference in milk yield (27.3 vs. 28.3 kg/day) between the two systems but the cows turned out in early spring produced milk of lower fat content (3.86 vs. 4.16%) and higher protein content (3.36 vs. 3.07%) compared to the indoor cows (Table 2). Cows from both feeding systems achieved similar DM intakes of approximately 15.5kg DM/cow/day. Significantly, the cows on the early spring grazing system continued to maintain a higher milk protein concentration and higher grass DM intake than their indoor counterparts up to July.

Table 2. The effect of system (Early Spring Grazing; Indoor Feeding) on the milk production characteristics of spring-calving dairy cows from February to April

	Early spring grazing	Indoor Feeding
Milk yield (kg/day)	28.3	27.3
Milk fat concentration (%)	3.86	4.16
Milk protein concentration (%)	3.36	3.07
SCM yield (kg/day)	26.6	25.9
Bodyweight (kg)	499	517
Bodyweight gain (kg/day)	+0.20	+0.03
Body condition score	2.87	2.92
Intake (kg DM/cow/day)		
Grass	12.9	-
Silage	-	5.7
Concentrates	2.8	9.6
Total intake	15.7	15.3

The results of this study highlight the large benefits (both nutritional and financial) of including grazed grass in the diet of spring calving dairy cows in early lactation. When modelled on a whole farm basis, early grazing will generate an increased profitability of €2.70/cow/day for each extra day at grass through higher animal performance and lower feed costs.

Management guidelines for early spring grazing

To capitalise on the benefits of grazed grass in early spring, dairy cows should be turned out to pasture directly post calving, ground conditions permitting. The main objectives of spring grazing management are:

1. to increase the proportion of grazed grass in the diet of the dairy cow,
2. to condition swards for subsequent grazing rotations. This can be achieved by grazing pastures to a low post grazing height during the first grazing rotation.

Similar to autumn grazing management, grassland budgeting is essential if these objectives are to be achieved.

The following key points should be remembered when managing early spring grazing:

- Farm cover at turnout should be approximately 700kg DM/ha, depending on mean calving date and stocking rate – an earlier calving date and/or higher stocking equates to higher animal demand and hence the requirement for a higher opening cover
- Aim to offer 0.8 - 1.0t grass DM/cow from turnout until the end of the first rotation – this should be achievable on farms where animals are turned out early.
- Grazed grass and concentrate can be the sole feed with such a system, allowing grass silage to be completely removed from the diet post calving.

- The available grass supply should be budgeted so that the first grazing rotation finishes around April 10 (the first rotation should be >50 days).
- Post grazing height must be maintained at 4-4½ cm during the first rotation to ensure pasture quality is high during subsequent rotations.
- During the first grazing rotation a low daily herbage allowance (15kg DM/cow/day with 3kg DM of concentrate) should be offered, this achieves the dual objectives of optimising dairy cow performance while maintaining sward nutritive value.
- From early April onwards (i.e. second rotation), daily herbage allowance must be increased in line with herd requirement to achieve high animal production performance throughout the lactation.
- Early grazed swards (February/March) have a similar grass growth potential compared to later grazed swards (April), but are capable of sustaining higher milk yields and grass intake in subsequent grazing rotations due to higher sward quality.
- Excessive pasture damage must be avoided.

Benefit of early turnout on grass quality in subsequent rotations

Swards grazed to low post-grazing residuals (4 - 4.5cm) in early spring (February and March) produce herbage of higher quality and higher milk production potential in the mid-April to early July period than swards which are initially grazed in mid-April. An experiment was undertaken at Moorepark looking at the effect of initial grazing date on milk production. Two swards were established, one was grazed once between February and mid April; the other remained ungrazed from the previous October/November. This study commenced in mid-April and continued for four 21-day rotations. Each of the swards was grazed at two stocking rates (grazing intensities), 5.5 and 4.5 cows/ha on the early grazed swards, and 5.9 and 5.5 cows/ha on the late grazed swards. The cows on the early grazed swards at a stocking rate of 4.5 cows/ha achieved the highest yield of milk, fat and protein; highest protein content and grass dry matter intake (GDMI) (Table 3). There was no difference in animal performance between the cows grazing the early and late grazed swards stocked at 5.5 cows/ha, even though the early grazed swards had already been grazed once that spring. The production benefits of swards grazed in early spring are due to a higher leaf proportion in the sward resulting in greater digestibility than later grazed swards during the main grazing season. Leaf proportion is directly related to grass digestibility; a 5.5% change in leaf content is equal to a 1-unit change in digestibility. For each 1-unit increase in organic matter digestibility (OMD) GDMI is increased by 0.20kg and milk yield is increased by 0.24kg milk/cow/day.

Table 3. Effect of initial grazing date and stocking rate on milk yield and composition from mid-April to early July

	Early grazed swards (grazed in February & March)		Late grazed swards (closed since previous October)	
Stocking rate (cows/ha)	**5.5**	**4.5**	**5.9**	**5.5**
Grass intake (kg DM/cow/day)	16.3	17.5	15.2	16.7
Milk production				
Milk yield (kg/day)	22.7	24.5	20.9	22.4
Fat (%)	3.89	3.78	4.00	3.78
Protein (%)	3.29	3.41	3.21	3.27

Restricted access to pasture during periods of wet weather

During the early spring period (and late autumn) weather conditions can be inclement thus restricting grazing opportunities. Management strategies such as on/off grazing can be used to ensure that cows have access to grazed grass without causing detrimental damage to sward surfaces and subsequent sward quality. Several strategies exist such as turning cows out for 3 – 4 hours after milking or allowing cows graze by day and then house by night. Recent research carried out in Moorepark has shown that animals adjust their grazing behaviour to compensate for reduced access to pasture thus milk production is not compromised.

Achieving high cow performance in mid season

During the main grazing season the objective is to achieve high cow performance from an all grass diet. This will be achieved by allocating an adequate quantity of high quality pasture. With good grassland management the nutritive value of grass can be sustained at a high level during this time (Table 4).

Table 4. Chemical composition of well-managed grass (>4cm) from March to November

(g/kg)	Mar	Apr	May	June	July	Aug	Sept	Oct/ Nov
Dry matter	179	182	184	182	177	191	165	137
Crude Protein	223	222	166	176	169	189	203	228
OM Digestibility	838	830	832	816	799	763	794	793

All swards 90-100% Lolium perenne pasture (late heading cultivars) managed under 250kg N/ha/yr. March pasture received 60kg N/ha in mid January; October pasture received last N in mid September.
Mid season grazing rotations April – July (18-22 days); August- Sept (24-30 days); Oct/Nov (30days+)

A study was undertaken at Moorepark in 2007 comparing two different pre-grazing yields (1600 and 2200kg DM/ha) grazed at two herbage allowances (16 and 20kg DM/cow/day) by dairy cows during the April to October period (Table 5). Cows grazing daily herbage allowances of 16 and 20kg DM/cow/day (> 4cm) had resulting post grazing sward surface heights of 4.2 and 5.0cm on the low mass treatment and 4.2 and 5.4cm on the high mass treatment, respectively. Highest milk production per cow and milk protein content was achieved with cows grazing the low pre grazing yield sward at the high grass allowance. Grazing swards with lower pre grazing yields resulted in higher grass utilisation, better sward quality and higher leaf content throughout the grazing season, which is reflected in higher overall production.

Previous research at Moorepark has shown that pastures with high grazing pressure (high stocking rate, low post-grazing height) in spring/early summer produced swards of lower herbage mass, lower post-grazing height, higher green leaf proportion and lower proportions of grass stem and dead material compared to swards with low grazing pressure (low stocking rate, high post-grazing height). Increasing post grazing sward surface height above 5 to 6cm results in a deterioration of sward quality in mid and late grazing season. Milk production results showed that pastures grazed to a post-grazing sward surface height of 5.5 to 6.5cm in the May to June period compared to 8 to 8.5cm achieved a higher DM intake (+0.8kg per day) and higher milk production (+1.2kg per day) in the July to September period. Additionally, in the May to June period there was no difference in milk production per cow from both swards, with the lower post-grazing swards achieving greater grass utilisation through higher stocking rates. Pasture topping can also be used to attain leafy swards and maximise animal performance. On average one round of topping, to a height of 4 to 4.5cm (to remove the tall grass around dung pads), should suffice from mid-May to late June. Swards mechanically topped to 4 – 5cm will support higher milk yields (up to 2kg/cow/day).

Table 5. The effect of pre grazing yield mass and daily herbage allowance on the performance of spring calving dairy cows (April to October)

Pre grazing yield (kg DM/ha)	*1600*		*2200*	
Grass allowance (kg DM/cow)	16	20	16	20
Milk yield (kg/cow)	20.0	21.0	20.1	20.8
Milk fat (%)	4.04	3.94	4.01	3.85
Milk protein (%)	3.37	3.44	3.37	3.41
Milk solids (kg cow)	1.46	1.57	1.50	1.50
Grazing stocking rate (cows/ha)	4.84	4.5	4.55	4.01
Pre grazing height (cm)	12.5	13.0	15.2	15.7
Post grazing height (cm)	4.2	5.0	4.2	5.4

Conclusions

There is considerable scope for dairy farmers to improve the profitability of their business by increasing the proportion of grazed grass in the diet of their dairy herd and hence animal performance from grass based systems. Efficient exploitation of grass by grazing requires the development of grazing systems designed to maximise daily herbage intake per cow while simultaneously maintaining a large quantity of high quality pasture over the grazing season. Grassland management and grass budgeting are the critical tools required to ensure an adequate supply of high quality grass over the entire grazing season. Daily grass intake can be maximised by maintaining a high proportion of green leaf within the grazing horizon and allocating an adequate daily herbage allowance. The challenge for the future is to develop swards through management and grass breeding that will maintain high DM intake while at the same time result in low residual sward height. Likewise in the future the cow genotype must be compatible with the milk production system. The development of reliable easy to use decision support tools that facilitate increased reliance on grazed grass to be used by farmers and extension services will contribute to optimising grazed grass based systems of milk production.

References

Dillon, P., Crosse, S., O'Brien, B. and Mayes, R.W. (2002). The effect of forage type and level of concentrate supplementation on the performance of spring-calving dairy cows in early lactation. *Grass and Forage Science*, 57, 212-224.

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

Kennedy, E., O'Donovan, M., Murphy, J.P., Delaby, L. and O'Mara, F.P. (2005). Effects of grass pasture and concentrate based feeding systems for spring calving dairy cows in early spring on lactation performance. *Grass and Forage Science*, 60, 310-318.

Shalloo, L., Kennedy, J., Wallace, M., Rath, M. and Dillon, P. (2004). The economic impact of cow genetic potential for milk production and concentrate supplementation level on the profitability of pasture based systems under different EU milk quota scenarios. *Journal of Agricultural Science,* 142, 357-369.

On farm options for profitable expansion

John Mc Namara
Teagasc/Carbery

Milk quota and nitrates directive

In considering options for expansion, it is important not to ignore issues relating to both milk quota and the nitrates directive. The former has not gone away yet, whilst the latter is here to stay. The best information to hand indicates that the EU will free up quota. No farmer can begin to expand without taking quota into account. This article is based on planning for expansion irrespective of whether extra quota is purchased, or if action is taken only when quota is no longer relevant.

The derogation under the nitrates directive allows a farm to stock to 250kg organic N per hectare (just short of 3 cows per hectare on the whole farm).

Taking account of both these realities, options will be presented of what a farm should do to profitably expand within the farm first, before considering options outside the farm gate.

Changing cattle for cows

This is a no brainer. It is well documented that cattle leave significantly lower margins compared to dairy cows. However, until the quota is there to increase cow numbers, it would be unwise to reduce the cattle enterprise. The transition should be a smooth process. Fixed costs will not be significantly reduced if by eliminating a cattle enterprise the dairy business ends up paying all the fixed costs, therefore leaving less end profit. Over the years it has been easy to say that cattle leave no money, so therefore get rid of them, but in practice unless the farm is able to increase milk production, profits are reduced. Therefore only swap cattle for cows on a livestock unit basis, as quota becomes available. This swap is not without costs in either housing or infrastructure but it does make sense to do it.

Increasing the cow grazing platform

The *cow grazing platform* is the land that is available to the milking cows. On most farms there is a 'traditional' area or block of land devoted to do this. However, there is scope to extend the area grazed by cows, by walking them further. Ideally try to minimize the number of public roads that have to be traveled or crossed. If we are imaginative there is scope on some farms to get access to more grazing ground for milking cows, by pushing the boundaries beyond the comfort zone.

It is important to breed the right type of cow for future needs. Cows of the future will have to walk further to get grass, so they need to have good feet and legs.

Increasing the stocking rate

There is plenty opportunity on most farms to increase the stocking rate on the grazing platform. While there is no reliable national data on the level of fragmentation of dairy farms, average stocking rate is less than 2 cows per hectare. It is suggested stocking rate could be profitably lifted to 3 cows per hectare on the dairy platform. This will ensure the whole farm still complies with the nitrate directive. Under the Nitrates Directive the maximium stocking rate allowed is equivalent to 2.94 cows per hectare. The land outside the grazing platform used for silage and young stock will dilute the overall farm-stocking rate down enough to comply with the nitrate directive. Increasing stocking rate is also going to have a positive effect in increasing grass utilization. In simple terms if you are carrying more cows per hectare there will be less wastage of grass. Living without quotas will allow increases in farm stocking rate to the most profitable levels. Where these levels lie are not known precisely as very few farmers are stocked above 3 cows/ha on the milking block. The nitrates directive will not in practice be an obstacle to achieving this target.

Milk solids not white water

This is not the time to continue the debate about milk payment systems, and in any case for most of the country it is now academic. Most milk purchasers have signaled when they will be paying for milk based on milk solids with a deduction for volume (the water element of the milk). Knowing this, it is important to breed the type of cow that will produce this milk in the future. The EBI system is identifying the bulls that will produce daughters that will be more profitable with this milk payment system. It has to be asked what is the industry waiting for, or what is it afraid of in its reluctance to implement a milk solids payment system immediately?

The amount of milk solids producing can be increased by breeding for high milk solids, remembering all the time that it is not the cow with the highest potential for milk production that gives the highest yield of milk solids, but the cow that calves in time. The cow calving in time gets enough days of lactation to allow her to express her potential for solids production. The late calving cow just does not have enough time to produce, no matter how high yielding a potential she has.

Calving date

Thirty percent of the national cow herd calves after April 1. These cows will have a reduced lactation length of at least 60 days. This is a lot of milk solids lost. The first issue for any farm expanding is to work on getting the calving pattern right for their farm. The optimum start of calving will vary with different parts of the country. In West Cork cows should start to calve from January 20.

This fits with getting cows to grass from February 1. Depending on the cow platform 'stocking rate', this may be cows getting all their intake in the form of grass and meals, or it may still be grass silage and meals. The objective is to maximize the grass intake into cows until the farm is bare and ready to go on magic day sometime in the first two weeks of April.

Calving pattern

By getting the calving pattern right once, it is a lot easier to keep it right rather than always fighting an uphill battle against late calving cows. It is possible to have a submission rate of 90% of all cows in the herd in the first 3 weeks of the breeding season, but this requires all cows to be calved at least 3 weeks before the start of breeding. Even with a conception rate of 50%, this still has 45% of the cows calving in the first 3 weeks next year. Throw in a replacement rate of 20% with 75% of the heifers in calf to first service and that's another 15% of the herd calving in 3 weeks. So 45% and 15% is 60% of the herd calving in the first 3 weeks. Continuing this on for the next 3 weeks will pick up the remaining 5% of the heifers and another 20% of the cows giving 85% calved in 6 weeks. Whilst some are doing this, it can be achieved by all.

The only way to fast track this process and get some satisfaction and profit out of a calving pattern is to decide one year you are going to sell all the late calvers and buy in heifers at the start of your calving. I agree there are disease risks doing this, especially for those with closed herds, but who really has a closed herd anyway? How many buy in stock bulls? The interesting feedback from farms that have done this, is that there is always a good market for late calving cows (after the quota year is over!) and the cost of replacing late calving animals with early calving ones is not as expensive as you would think. Once you do this you are getting the benefits of the early calving immediately.

Research and farm data has shown that the cow with plenty of time between calving and breeding has a much higher chance of going in calf than the cow with only a short time. A rule of thumb is that the chances a cow will stay in calf are the same as the number of days from calving (up to day 50). So a cow calved 30 days has a 30% chance of going in calf. Compact calving makes compact calving easier!

Heifers calve at the start of calving season

Fairly obvious but not everyone is doing this yet. Feed whatever is necessary to get heifers heavy and mature enough to be bred as yearlings in time to calve early. Once you have all the heifers calving early then you can look at reducing the costs of getting them to the right stage for breeding. Plenty are able to have heifers ready for breeding with no meals except some calf starter. To get there it takes good calf rearing, excellent grassland management, and good silage the first winter.

The first objective is to give the heifer an easy calving, so if that means putting her in calf to a greyhound so what! With the shortage and cost of replacement heifers it is tempting to breed replacement heifers to Friesian AI. If the heifers are big enough by all means do that, but do not get into a situation of heifers having difficult calvings or a long gestation length. In the bigger picture this is the wrong way, chasing short-term gain. Get the big picture right first, give the heifer an easy calving, Jersey AI fits this perfectly and you still have valuable heifer calves.

Synchronising heifers

This offers a number of advantages; it gets more heifers calving early, and it allows for them to be moved off the home block sooner. The one shot PG program is attractive because there is less veterinary intervention, and it can give 75% of the heifers calving at the start of the first 3 weeks of calving, and it is cost effective. The remaining heifers will also breed sooner on second cycle and thus calf earlier too. With this program the heifers are at home for 10 days or they are observed for 10 days, and then an easy calving stock bull is let off with them.

Cow type

EBI is delivering the cow we need for the future. The biggest factor reducing milk solids production per farm is calving pattern. Breeding for fertility in spring calving herds increases farm profit. Choose bulls based on fertility until the calving pattern and fertility are those required. Then start looking at milk solids production. It is interesting to note that in New Zealand where herd size is much bigger, way less attention is given to breeding yet they still achieve good fertility. In Ireland, some farmers have very good submission rates and calving patterns with black and white cows from relatively small herds. They are very good operators who put a lot of effort into the breeding season. However, as herd size increases and the attention given to breeding inevitably declines, will our existing black and white cows be right for larger herds?

Having the stock to expand

Anyone producing in-calf heifers for sale is facing a rising market. There are not enough heifer calves on the ground in 2007 to allow for expansion. Hopefully this figure will improve in 2008, but a lot of the increase will unfortunately come from stock bulls. Even the top 25 discussion groups in the country (at the recent EBI 'groups day') only had enough heifers to expand by 9%. All talk about expansion is only so much hot air unless there is a plan in place to either produce or source in-calf heifers.

It generally takes at least 5 AI straws to produce a PWO (Perfect Working Order) heifer in the herd. This means that to have enough heifers to expand, there is a requirement to use at least 1.5 AI straws per cow in the herd. Using AI dairy sires on bulling heifers increase the heifers you produce. However see previous comments.

Contract rearing of replacements

There are some very good people exiting the dairy industry that would still like to be involved. They are great stockmen, and are interested in rearing replacement heifers for other farmers. This is progressing slowly and quietly. '*Seek and ye shall find*'. Yes there is need for some sort of a standard agreement that could be modified for each particular situation. This is widespread practice in New Zealand. The disease implications where the rearer has just one dairy farm's heifers can be overcome. In the event of a disease breakdown, provided the dairy farm agrees to get locked up the in-calf heifers can be transferred to the milking farm. Contract rearing heifers especially from an early age has a lot of advantages to the milking farm. It saves on labour at a very labour intensive time of the year, and it frees up more land for milking cows if the drystock are on the home block. It is important that the breeding of these replacements (the future herd) is done to a high standard or else all the advantages could be lost quickly.

Farm infrastructure

Investing in better farm roadways, paddock layout and water supply all contribute to increasing milk solids production off the existing farm. Make sure you can access the entire farm with milking cows. Land that has been traditionally grazed with drystock because it was inconvenient for cows will have to be looked at with fresh eyes when expanding.

Maximising grass production

Drainage

Wet land on farms may not have been limiting milk production to date because there was not enough quota to require this land. This is valuable land. It will pay to improve the drainage of land like this to allow more access to it for longer in the year, and also because drained land will produce more grass.

Soil fertility

It was always good farm practice to soil sample every four years. Today there is no choice but to act on the soil results and get the lime status correct. Then work within the limitations of the Nitrate Directive with regards to soil P status. More and better use must be made of slurry to improve soil fertility. Slurry is not a waste but a valuable fertilizer.

Reseeding

Over the years many people have been discouraged from reseeding, because they considered that the production from the field was not limiting farm output. In general (except for silage ground) you can improve the grass quality of most grazing land by intensive grazing. However, it is difficult to get a window of opportunity to reseed when highly stocked (>2.5cows/Ha). Taking a field out for reseeding compromises (and therefore costs) the grazing plan. So that for those farms planning to expand it is better to have the reseeding done before the extra production is needed.

Grass varieties

Farmers need to actively consult the DAFF recommended lists of grass and clover, which are published each year. Information is now available on spring and autumn growth, date of maturity, ground cover score and quality parameters such as digestibility and WSC (sugar) content. Further developments can be expected. Late heading varieties are delivering the goods on farm, but don't forget the difference between a late and an intermediate variety could be only one day. Late heading is classified as heading after June 1, intermediate is before June 1 so don't reject all intermediate grasses out of hand. There is also a need to see how overseas varieties perform in Ireland (in Department of Agriculture Evaluation trials) before they are set on farm. From experience, the current "buzz" New Zealand grass Bealey appeared very disappointed when seen in its own country last November - don't jump in with grass unproven in Irish conditions. Reseeding is an expensive business, once is enough to do it!

Increasing grass quality and utilization

Unless farmers are grass budgeting, they cannot be serious about profit and maximizing production. Grass budgeting increases milk solids output and profit, by ensuring optimal use of bought in feed supplementation, maximizing production from grass and keeping grass quality high. Loads of people can reel off these advantages, but how many are just "talking the talk" and not "walking the walk". Budgeting involves walking the farm at least once per week. If time cannot be made available for this exercise it means less profitable tasks are given priority, and a reappraisal is needed. Look at the things that influence profit the most and concentrate on those. Fit other non-essential things in later if at all.

Increasing stocking rate above 3 cows/hectare

Depending on the yield and pattern of grass production on the farm, it may be possible to stock at higher than 3 cows per hectare on the grazing block. However, there is a point beyond which it is not possible to go without supplementary feed at the shoulders of the year (Feb – April and Sept – Nov), which may in turn lead to a higher cost farm structure chasing the extra production from brought in feed. Note that 'brought in feed' includes home produced maize silage etc. Increased production may not result in extra profit. Extra production from brought in feed may be profitable when the milk to feed cost ratio is in the farmers favor, but if such systems are put in place to feed at times of high milk price, it is not so easy to stop the habit when the equation turns the other way.

In lots of situations, bought in ration fed in the parlor is the most cost effective way to provide supplementary feeding. There are no "hidden" costs of supplement storage and feed out costs. These "hidden costs" are easily disguised in farm accounts or "sure we needed the tractor anyway" stories. However for most people, once they are maximizing grass production and utilization, it will not pay to increase stocking rate by bringing in supplementary feed. It will be more profitable to devote money and time to other activities that will give higher returns, e.g. having more family time or time to think.

Profitable grass based dairy farming in Ireland

Kevin and Margaret Twomey
Renny, Ballyhooley, Co Cork

Key Messages

Produce a plan and implement it.

The advantages of a relatively low cost system are;

- More profitable – less capital in machinery/labour,
- Easier managed – cows turned out as they calved to grass,
- Easier to grow/expand – basic fixed costs maintained.

Measurement drives success.

Labour efficiency is the key; implement as many new technologies as possible.

Mission Statement

Strive to be excellent in the business of dairy farming, and to manage a highly profitable, simple system that is benchmarked against the best, and to embrace and implement the best knowledge available. Also to balance the workload to maintain an enjoyable lifestyle where business and relaxation intermingle and are richly rewarded.

Introduction

As a new entrant in 1994/95 on a farm of 50 adjusted hectares, the business today (2007) milks 196 cows selling over 1,000,000 litres of milk to Dairygold. The 5-year plan in 1994 was to milk 70 cows in 1999 based on a spring calving system. The farm had to be efficient as most of the quota was leased, and it had to be operated as a one-man unit with some spring help. Therefore from the outset the objective was 'profit' not 'milk yield'. Why? To make money out of leased quota on a new expanding farm, the business had to be efficient. As the herd was expanding, the aim was to breed highly reproductive cows rather than high milk production. This has been the key to the business.

A relative low cost system was developed because:

- More profitable – less capital in machinery/labour;
- Easier to manage – cows turned out as they calved to grass;
- Easier to grow – basic fixed costs were maintained.

The cow to grass system is the 'Blue Chip Dairy Farm' every owner/investor should aspire to. Why? It has the ability to keep good cost control, offers excellent efficiencies, and will stand the test of time through the lows and highs.

As expansion in the last few years has slowed due to quota restraints, options for selling surplus heifers continue to boost farm profits.

Work routine

A typical day around March 10.

- Start at 6am. Bring in milkers and set up next paddock for milking. Cups on for 6.30am. Finish milking and wash up at 8.30am.
- At 7.30am farm staff (x1) start work by putting fresh calvers into collecting yard and feeding calves.
- After milking and breakfast, settle down to administration work.
- Return to farm from 11am to 1pm to do farm covers, sort cows calving, move cows/heifers on crops.
- Start again at 3.30pm. Put cups on at 4pm, finished at 6pm. One-person milks while another sorts feeding dry cows, calves and cows for calving.

Stock management – spring routine

Calf Rearing: - calves 0 to 5 days old are fed milk twice a day; from 5 to 6 days old they get milk once a day. Calves are turned out at 3 weeks old. Each calf gets 5 litres of milk and no meals. Calving problems are rare. Cows are generally left to calve on their own. Cows are checked at 10.30pm and only during the night if it is considered that something is amiss. Dry cows get a high spec pre calving mineral. On average there is one case of milk fever a year, but no cases of grass tetany. Vet calls are approximately 2 per year. Stock are vaccinated for Leptospirosis and BVD as a precaution. There are nearly always some cases of scour in housed calves around the last week of March; in the main calves that are outside escape this. Any individual calf that gets scour outside is kept outside with their batch and just given a tablet.

A typical day in early June

- Morning milking - cups on at 6.30am; finish at 8.30am.
- Evening milking - 4.00 - 5.30pm.
- There is always one person on and the other one off.
- There is about 1 hour a day spent on replacement stock.

A specific day will be set aside for different jobs:

- Fertiliser is spread one day a week;
- Farm cover is measured one day a week;
- Fencing is repaired – one day a month;
- Topping (every field is cut once either for silage or topped during the year);
- In general either the farm worker or manager are free 4/5 hours in the middle of the day unless one of the designated jobs above have to be done.

Why take time off the farm after breakfast? This 'FREE' time after breakfast or in the middle of the day is without doubt the most valuable. It allows time to sort administration – buy/ordering inputs etc., as you are fresh and alert and all businesses are open etc. In addition this time is used to manage the business, plan for what is next, next for tomorrow, next week, next year. Planning is crucial to success in any business.

Why Plan?

- Where are you now?
- Where do you want to be in 5 years?
- Where do you want the business to be in 5 years?
- Why do you want it?
- What are you going to do to get there?

Discussion groups

A lot of time is given to Discussion groups etc. As a member of 4 (Blackwater Group, Grazing Musketeers, Ballyhooley/Fermoy Teagasc, Dairygold/Teagasc Monitor Farm), attendance is considered a priority in advancing the farm business. This is because acquiring knowledge from ones peers is hugely beneficial to successful planning and staying at the cutting edge of technology. Research being done in Moorepark has made a significant contribution to the farm business, generating farm efficiencies and allowing the business to continue to grow and prosper.

Recent farm developments

The business has developed over the years as a profitable growing business, with systems in place that have evolved to handle large numbers of cows efficiently. 'Efficient expansion' is the key. The ability to change and adapt is very important, and as such the following areas are typical of this;

- *Grassland Management* – From having an idea of farm cover to understanding the enormous benefits of utilising it;
- From spring turnout of 3 hours/day to full time at turnout unless inclement weather where the cows are then on/off;
- From feeding grass/silage and meals to feeding grazed grass and ⅔kg of meals;
- From maximum performance to optimum performance.

- *Calf Rearing* - Moving from twice a day feeding to once a day;
- Moving from straw bedding to bedding with wood chips;
- Moving calf turn out from 2 months of age to 2 weeks.

- *Wintering* - Moving from a strict silage and concentrates winter diet to crops, silage and flexibility.

- *Infrastructure* - Cows walking across a very busy main road to installing a farm underpass;
- From one entrance per paddock to multiple entrances per paddock;

- Moving from a 10-unit parlour to 20-unit parlour.
- Simple drafting gate and side-by-side crush.

Discussion Groups

Participation in discussion groups - especially the Blackwater Discussion Group and more recently the Grazing Musketeers Group with Gary Nolan is essential to opening the mind to change, and change is good. Having participated in the local discussion group led by John Maher and Paddy Crowley since 1994, it is great to see how these groups have evolved. Teagasc Advisory under the guidance of Matt Ryan can now deliver new technologies from research for farmers to adopt. Going from 40 to 200 cows over the last decade affords a huge advantage over most, and it's not the 200 cow factor, it is the mindset. By listening, learning, and understanding knowledge from top farmers, top researchers and top farm advisors both nationally and internationally; strategies can be implemented that suit not only farm goals, but also family life and non-farm activities. The decision in 2006 to take on a full time person may be viewed by some as a decrease in efficiency. Prior to that date the farm was managed at just over 16 hours/cow/year. In 2007 with the additional labour unit this increased to 24 hours/cow/year because the owner's labour is under-utilised. Why become more inefficient? The reason is that time devoted now to strategic planning and better management practices, will again reduce time back to 16 hours/cow when in the future the number of cows milked climbs to 300. As the business grows, time is more productively spent outside the parlour!

Table 1. Progress in the *Twomey* farming system

Year	1995	1998	2001	2003	2005	2007
ha	50	55	61	83	83	106
Cows	40	84	123	145	155	196
Variable costs (c/l)	6.4	5.4	5.2	7.39	6.7	6.84
Fixed costs (c/l)	11.6	10.4	11.7	9.18	8.5	8.23

Key points to growing a business

1. Identify the system that can deliver high profit growth;
2. Implementation of system – set the farm up for spring grass production;
3. Breed for compact calving;
4. Simplify work routines – e.g. calf rearing;
5. Get milking/drafting right;
6. Good infrastructure;
7. Benchmark/measure performance/Discussion Groups - research and compare with peers;

8. Plan forward;
9. Positive Mental Attitude (P.M.A.) - Quest for Knowledge – constant reviewing and continuous evolvement.

Objectives on *Twomey* farm

- To grow farm profit by 5%/year;
- To deliver more milk solids. Aim for 450kg milk solids/cow in 2 years and 475kg in 5 years;
- Variable costs to be reduced and maintained below 7c/l;
- Increase stocking rate to 3cows/ha on the milking platform;
- Compact calving – have over 90% calved in 6 weeks.

Future issues

Is it EU policy to have death by 1000 cuts within the Dairy Industry? The uncertainty of Milk Quota 2008 – 2014, puts Ireland into a very uncomfortable situation. There is now a very low floor to the market, however we have about 6 years before guaranteed limits come off. Six years of preparing dairy farmers for limitless production is very dangerous. Logically one can only be 1- 2 years preparing then action is required. If the Milk Quota tap is still closed by 2010 we, as a nation will begin to lose our enthusiasm and vision. We may even lose another generation of farmers! Many other issues are recognised that need to evolve, i.e. land fragmentation/land lease etc., but milk quota is No.1 in the short term if farmers want to grow and expand. The EU want more efficient farms in the future, then we need at least 5% increase in quota per annum immediately. There is need for a joint approach between farmers, co-ops and the Irish Dairy Board to show leadership to develop a Dairy Strategy for Ireland.

Young farmers

It is almost 5 years since there has been a brand new dairy entrant. This is not sustainable. The industry requires at least 100 new farmers a year because there are about 800 - 1000 people exiting the business for various reasons every year. Along with the 2% proposed increase from 2008/09, Ireland should seek an additional 1% (45,000,000l) of EU unused quota to be given in blocks of 400,000l to brand new entrants on green field sites. This is the equivalent of setting up 100 new dairy farmers.

The EU must give young people an opportunity to invest themselves into dairy production, by giving them a license to produce before 2014. This means young farmers would still have to invest in infrastructure costs (cows, parlours, roadways etc.), but can do so at a reasonable scale to get started and be sustainable. This is equivalent to about a half million € investment, - how many are brave enough to take that on?

We need:

- Innovation – calf rearers;
- Replacement rearers;
- Winter grazers;

The best research information.

Expansion and profit: thinking of expansion? Cost implications and options for farmers

Michael Brady

Brady Group - Agricultural Consultants & Land Agents. The Lodge, Lee Road, Cork.

Introduction

Dairy Farming is back in fashion. Increased milk prices and the predicted demise of E.U. milk quotas are the main drivers in a renewed enthusiasm for expansion of dairy farm businesses. Dairy Farmers in most dairy intensive regions of Ireland have been starved of opportunities to expand their businesses since the change in national milk quota legislation in October 1999, which prohibited new land and milk quota leasing. The decoupling of the E.U. Single Farm Payment, poor profitability from traditional enterprises and government grant schemes for farm buildings coupled with the main drivers of improved profitability and the possible demise of milk quotas have combined to present dairy farmers with a strategic decision to make on the future expansion of their businesses. Given the historical and current social slant in Irish agricultural policy to retain as many people as possible on the land, will expansion of dairy business be widespread? Is a proposed expansion of an individual dairy business a viable proposition?

This paper examines the essential requirements and options for the successful expansion of a dairy farm business.

Expansion of a dairy farm business – the essential criteria

Today, Irish dairy farmers can be categorised into four distinct groups. They are described as follows:

- Scale: Dairy farmers who have grand plans for large scale expansion;
- Safe: Dairy farmers who have plans for small scale expansion;
- Stop: Dairy farmers who have achieved their business goals;
- Scared: Dairy farmers who don't know where their business future lies.

There are a number of factors which motivate dairy farmers to expand their business, i.e. increased profit, increased cows numbers, more land, more milk quota, family pride, continuation of the family business, etc. Whatever the motivation factor, there are a number of essential criteria for the successful expansion of a dairy farm business. These criteria should be rigorously assessed before commencement of any plan for expansion. The following essential criteria for the successful expansion of a dairy business are listed in order of importance:

Ambition - focus

A dairy farm business is a time consuming year round career. Increasing the scale of a dairy business adds to the list of management skills required. Expansion of a dairy business requires a driven ambitious individual with stated goals and a clear focus on how to achieve those goals.

Grazing area around the milking parlour

The majority of milk produced in Ireland is low cost, grass based, spring milk production systems. Grazing area around the milking parlour is critical for expansion of these production systems. The small fragmented structure of Irish farms and the inherent bond to the land by landowners will make this a difficult bridge to cross for many dairy farmers.

A minimum of 65ha (160acres) but preferably from 100ha (247acres) upwards must be available within grazing distance of the milking parlour if realistic expansion plans are to be realised.

Ability to manage labour – people skills

The successful dairy farmer of the future must have excellent people skills. It is accepted that 1 labour unit is required to run 100 cows plus replacements. Increases in the scale of larger units will be in increments of 100 cows, which will involve the employment of additional staff. Irish dairy farms are traditional small family farms therefore there is no history or experience of employing and managing staff. Cows don't talk back but people do. There is a major gap in the skill level of dairy farmers in management of employed labour. Up-skilling is urgent for successful expansion of dairy farm business.

Financial literacy – bank and business planning

A large expansion programme requires a financially competent dairy farmer. There is no greater ill than to have cash flow difficulties in the middle of an expansion project or during a busy period. Large-scale dairy farming is a business as well as a way of life. A financially competent dairy farmer will follow the pursue the following to successfully carry out an expansion programme:

- List, plan and cost all items for capital investment and add a safety margin (10%).
- Calculate the financial facilities required and plan taxation.
- Prepare a farm business plan and/or a partial budget showing debt repayment capacity, sensitivity analysis and contingency plans.
- Negotiate finance, security, interest rate and terms and conditions.
- Plan a timetable of events for the completion of the project.
- Monitor income and expenditure by quarterly accounts versus the plan.

A dairy farmer intimately familiar with the up to date finances of the farm business will identify opportunities and weaknesses early. This will ensure a better relationship with the bank while giving the farm business a definite edge on competitors when making important decisions.

Technical efficiency

Technical efficiency is critical to excellent physical and financial performance of a dairy farm business. However Irish farmers have a habit of over emphasis on fashionable technical efficiency factors to the detriment of financial and other important factors. Prioritise the technical efficiency factors that require improvement on your farm.

Time management

There are only 24 hours in a day. One labour unit can only handle a 100 cows and replacements. Expansion does require time. You cannot do everything yourself. List and prioritise tasks and plan how and who will carry them out. Work smarter not harder.

Mentor and team

It is vital to have a trusted sounding board for the management of expansion projects and the day to day running of a dairy farm business. Every business owner needs a core team of trusted advisors/mentors. The team should consist of a dairy advisor/consultant, tax advisor, legal advisor, banker and possibly a person outside of farming. Dairy farmers should draw on the excellent research done by Teagasc Moorpark (via membership of a relevant discussion group) and fine tune with one to one contact with the advisor/consultant.

Stable personal life

Dairy farmers, farming in partnership with their wife, family or non-family must encompass all partners in expansion plans. Expansion projects are stressful events as they draw on time and finances, both vital characteristics in a stable personal life. Often the enlarged farming programme after the expansion project can take time to implement. One in five marriages in Ireland today are ending in divorce. In an existing fragile relationship these events can cause a complete breakdown. **Do not consider a farm business expansion project if you do not have a stable personal life**.

A successful expansion of a dairy farm business is directly related to all of the above essential criteria. The larger the scale of the expansion and the higher the level of risk, the more essential the criteria become to enable the dairy farmer to successfully navigate the stressful periods in the project and the enlarged farming programme. If a dairy farmer meets all the essential criteria for successful expansion of the business, what options are available to expand?

Options for expansion of a dairy farm business

This paper considers expansion of a farm business as '*increasing both the amount of land farmed and the number of cows milked*' (it is acknowledged that expansion can also occur within the farm gate by changing from other enterprises to dairying). There are three areas to consider when increasing the amount of land farmed and the number of cows milked:

- Buying land;
- Leasing land;
- Investment syndicates.

The route of expansion will be individual to each farm business depending on its particular set of circumstances. To examine the options for expansion of a dairy farm business, an example is described (Tables 1 & 2). The example farmer is chosen because there is limited capacity to expand within the farm gate in the current dairy unit. It is assumed that the farmer meets all the essential criteria for a successful expansion plan as outlined above.

The options for expansion of the dairy farm business are then examined.

Table 1. Example dairy farmer – farm business data

Personal	
Age	34
Martial status:	Married
Spouse	Age 30 – currently works in the home
Children	3 school going children
Education	Both qualified young farmers
Physical	
Land	50.6 ha (125 ac) all grazable by cows
Dwelling house	Traditional 2 storey farmhouse
Milk quota	613,722 litres (135,000gall) @ 3.8% butter fat
Livestock	100 cows / 23 calves / 23 ICH / 2 stock bulls
Buildings	20u parlour / 125 cubicles / pollution
Machinery	Basic machinery – silage & slurry by
Labour employed	Casual relief - €5k/annum
Technical	
Stocking rate (LU/ha)	2.47 (1LU/ac)
Milk solids (%)	3.4% protein & 3.8% butterfat
Milk solids sold/cow (kg)	455 (1350gall/cow sold)
Milk Solids sold/ha (kg)	1,123
Feed/cow (kg)	533
Single payment scheme (€)	20,000
Financial summary	**€**
Net farm profit*	130,000
Personal drawings	50,000
Income tax	20,000
Depreciation provision	15,000
Bank €200k - 20 yrs @ 6%	17,200
Surplus for Investment	27,800
Net worth	3.5 million
Sensitivity Analysis	**€**
Milk +/- 1c/litre	6,137
Feed +/- €10/tonne	533
Interest +/- 1%	2,000
SPS +/- 10%	2,000

**Net farm profit before bank and depreciation*

Table 2. Income and expenditure account for example dairy farmer

Income		(€) Total	(€) c/l sold	(€) €/ha
Milk Sales	33c/l	202,528	33.0	4,004
Calves	82	10,250	1.7	203
Cull cows	21	7,350	1.2	145
Bulls	1	1,000	0.2	20
SPS		20,000	3.3	395
Less Livestock Purchase		-1,800	-0.3	-36
Total		**239,328**	**39.0**	**4,731**
Expenditure				
Variable costs				
Fertilizer & lime		13,971	2.3	276
Concentrates		19,322	3.1	382
Seeds & sprays		1,500	0.2	30
Machinery hire		12,171	2.0	241
Vet, med & AI		13,287	2.2	263
Misc. variable costs		3,425	0.6	68
Total Variable Costs		63,676	10.4	1,259
Gross Margin		175,653	28.6	3,472
Fixed costs				
Labour		5,000	0.8	99
Mach. op. costs		11,000	1.8	217
Insurance		3,500	0.6	69
Car, phone & electric		16,000	2.6	316
Gen maint & repairs		6,000	1.0	119
Prof fees		3,000	0.5	59
Misc.		1,000	0.2	20
Total Fixed Costs		45,500	7.4	899
Total Costs		**109,176**	**17.8**	**2,158**
Net Margin		130,153	21.2	2,573
Inventory change		0	0	0
Profit before depreciation and interest		**130,153**	**21.2**	**2,573**

Expansion options for the example farmers business

The example dairy farmer is milking 100cows, has 23 replacements and 2 stock bulls on 125acres (stocking rate 2.47lu/ha or 1lu/ac). All the land is available for grazing by the cows. Bank debt is €200,000. The following options are considered for the future of the farm business:

Table 3. Expansion options for the example farmer

Options	Cow No.	Acres	Quota Gall	Labour Unit
1. Present system: - *125 acres owned*	100	125	135,000	0
2. New dairy unit: - *add a new 125 acre stand alone unit*	100	125	135,000	1
3. Double home unit: - *add 125 acre unit next door*	200	250	270,000	1
4. Max grazing block: - *add 70 acres*	156	195	210,600	0
5. Land for replacements: - *add 32 acres*	125	157	168,750	0
6. Small increase: - *add 13 acres*	110	138	148,500	0

The above options are achieved either by buying or leasing the land required for the expansion plan. The following is a description of the reasoning behind each option.

Option 1 - Present System: Continue the present 100-cow spring milk system. This is included as a comparative as the profitability outlined in Table 2 will be the basis for calculating the net profit of the other options.

Option 2 – New Dairy Unit: This option examines the viability of running a second stand-alone dairy unit identical to the home unit. The difficulty in obtaining land adjoining or near the home dairy unit in Ireland today is acknowledged. The example farmer acquires the new unit as a going concern (land, buildings, farmhouse, quota, SPS, livestock, machinery) within a 50km radius of the home unit. It is run as an entirely separate unit as it is too far to have any fixed cost savings. It is assumed a fulltime labour unit is employed, housed rent free in the farmhouse and given the use of a jeep. It is also assumed that technical and financial efficiency factors are the same as the home unit. Both buying and leasing are examined.

Option 3 – Double the Home Unit: This option assumes the stand-alone unit as described in option 2 is acquired alongside the home unit. There is no additional machinery purchased and there are savings in fixed costs. The additional labour unit is still employed even though there is an option for Mrs Example Farmer to replace the employed unit and let out or sell the farmhouse. Both buying and leasing are examined.

Option 4 – Maximise the Grazing Block: This option maximises the number of cows the example farmer can milk from the 125 acres he currently owns and farms. It assumes that 1 hectare can carry approximately 3 cows (1.25cows/acre) at the back end of the year; therefore the 125 acres can carry 156 cows. An additional 70 acres are acquired. This land can be within a 15km radius of the home farm. Both buying and leasing are examined.

Option 5 – Land for Replacement stock: This is a conservative version of option 4 where the stocking rate on the grazing block at the back is under less pressure at 2.47lu/ha (1lu/ac). An additional 32 acres are acquired. This land can be within a 15km radius of the home farm. Both buying and leasing are examined.

Option 6 – Small Increase: This option examines an opportunistic acquisition of 13 acres. This land can be within a 15km radius of the home farm. Both buying and leasing are examined.

Buying land for expansion

The capital investment required to buy the land and other assets in each of the options is outlined in Table 4. The capital investment sums range from €3.7 in option 2 to €338,3983 in option 6.

Table 4. Capital investment schedule for dairy unit expansion options – buy land

	Option 1 (€) Total	Option 2 (€) Total	Option 3 (€) Total	Option 4 (€) Total	Option 5 (€) Total	Option 6 (€) Total
Detail of assets purchased						
Land & Bldg - ac		125	125	70	32	13
Quota - litres		613,722	613,722	343,684	153,431	61,372
SPS		20,000	20,000	11,200	5,000	2,000
Cost of assets purchased						
Land & buildings		2,845,758	2,845,758	1,593,624	728,514	295,959
Milk quota		171,842	171,842	96,232	42,961	17,184
SPS		40,000	40,000	22,400	10,000	4,000
Dwelling house		350,000	350,000	0	0	0
Machinery		80,000	0	0	0	0
Livestock		212,400	212,400	118,944	53,100	21,240
Total Capital Invested	0	3,700,000	3,620,000	1,831,200	834,575	338,383
Capital Invested per acre	0	29,600	28,960	26,160	26,080	26,029

The feasibility of purchasing the land in each of the options is outlined in Table 5. The purchase of the new stand alone dairy unit in option 2 is calculated to have a deficit of funds of €136,847 per annum when paying interest only at 6%pa on the €3.7million to buy it. It has a Return on Investment (RoI) of 2.7%pa, well below the interest rate of 6%pa. Clearly this is not a viable option as a stand alone unit with all funds borrowed. Option 3 also shows a deficit of funds and is also non viable on borrowed funds. Option 4 has a surplus of €13,146 after paying interest only on all loans, however this surplus is too small to make capital repayments on the loan. Option 5, the purchase of an additional 32 acres, buildings, milk quota, SPS and livestock to increase from 100 to 125 cows (plus replacements) is very close to making a 20 year repayment schedule. However the business would be very vulnerable to negative movements in milk price and interest rate. Option 6 the purchase of an additional 13 acres, buildings, milk quota, SPS and livestock to carry an extra 10 cows and replacements is viable on a 20 year repayment schedule.

Table 5. Source and application of funds for dairy unit expansion options - buy land

	Option 1 (€) Total	*Option 2 (€) Total	Option 3 (€) Total	Option 4 (€) Total	Option 5 (€) Total	Option 6 (€) Total
Source of funds						
Net profit	130,153	100,153	245,305	211,018	167,316	145,218
Farmhouse rental			0			
Total source of funds	**130,153**	**100,153**	**245,305**	**211,018**	**167,316**	**145,218**
Application of funds						
Personal drawings	50,000	0	50,000	50,000	50,000	50,000
Income Tax	20,000	0	0	11,000	14,000	17,000
Depreciation provision	15,000	15,000	15,000	15,000	15,000	15,000
Bank interest @ 6%	12,000	222,000	229,200	121,872	62,074	32,303
Surplus/ Deficit of funds	33,153	-136,847	-48,895	13,146	26,241	30,915
Total application of funds	**130,153**	**100,153**	**245,305**	**211,018**	**167,316**	**145,218**

**Option 2 is a stand-alone option, existing debt of €200k not included in interest payment.*

Lessons from buying land to expand:

- Borrowing all the funds to buy land will ensure the scale of expansion will be limited.

- If the stand-alone unit in option 2 is to be feasible on a 20 year repayment schedule, the farm should cost €990,151 (€7,921/acre) versus the market value €3.7million (€29,600/acre) in the example!
- The annual yield or Return on Investment (RoI) in land is low (2.7% in option 2 above).
- Buying land allows the possibility for investment gains by it increasing in value over time i.e. capital appreciation. This suits the cash purchaser.
- Land has a good historical record of capital appreciation in Ireland.

Leasing land for expansion

The capital investment required in other assets when leasing land for expansion is outlined in Table 6. The capital investment sums range from €292,400 in option 2 to €21,240 in option 6 and are modest when compared with buying land, buildings, SPS and milk quota. It is assumed for the purposes of the exercise that the buildings are rented with the land. Milk quota purchase has also been omitted due it its non-availability in most areas and its predicted demise. The cash surplus can be used to calculate the option of purchasing milk quota and or erecting buildings.

Table 6. Capital investment schedule for dairy unit expansion options - lease land

	Option 1 (€) Total	Option 2 (€) Total	Option 3 (€) Total	Option 4 (€) Total	Option 5 (€) Total	Option 6 (€) Total
Detail of assets leased						
Land & Bldg - acres		125	125	70	32	13
Quota - litres						
SPS						
Cost of assets purchased						
Land & buildings		0	0	0	0	0
Milk quota		0	0	0	0	0
SPS		0	0	0	0	0
Dwelling house		0	0	0	0	0
Machinery		80,000	0	0	0	0
Livestock		212,400	212,400	118,944	53,100	21,240
Debtors		0	0	0	0	0
Total capital invested	**0**	**292,400**	**212,400**	**118,944**	**53,100**	**21,240**
Capital invested per acre		**2,339**	**1,699**	**1,699**	**1,659**	**1,634**

The feasibility of leasing land to expand the dairy business in each of the options is outlined in Table 7. All the land is leased at €200/acre, there is no SPS. Leasing land to expand the dairy enterprise shows a surplus of funds in all options. The lease of the new 'stand alone dairy unit' in option 2 is calculated to have a surplus of funds of €18,609 per annum. This will allow the capital to be repaid on the loan of €292,400 for stock and machinery over 10 years. Banks consider this period too long, therefore this option is considered high risk. The annual yield or Return on Investment (RoI) in option 2 is 18.9%pa, well above the interest rate of 6%pa. The other options are all viable and leave enough of a surplus to consider purchase of milk quota and construction of pollution and winter housing facilities. Option 3, the doubling in size of the home unit by leasing another unit alongside it shows a good net profit and surplus of funds, however income tax burden is increasing due to the high profitability and low bank interest payment. Options 4, 5 & 6 are all attractive options.

Table 7. Source and application of funds for dairy unit expansion options - lease land

	Option 1 (€) Total	Option 2 (€) Total	Option 3 (€) Total	Option 4 (€) Total	Option 5 (€) Total	Option 6 (€) Total
Source of funds						
Net profit	130,153	55,153	200,305	185,818	155,916	140,618
Farmhouse rental						
Total source of funds	**130,153**	**55,153**	**200,305**	**185,818**	**155,916**	**140,618**
Application of Funds						
Personal drawings	50,000	0	50,000	50,000	50,000	50,000
Income Tax	20,000	4,000	43,000	39,000	29,000	23,000
Depreciation provision	15,000	15,000	15,000	15,000	15,000	15,000
Bank interest @ 6%	12,000	17,544	24,744	19,137	15,186	13,274
Surplus/ Deficit of funds	33,153	18,609	67,561	62,681	46,730	39,343
Total application of funds	**130,153**	**55,153**	**200,305**	**185,818**	**155,916**	**140,618**

**Option 2 is a stand alone option, existing debt of €200k not included in interest payment.*

Lessons from leasing land to expand:

- Leasing of land to expand the dairy enterprise is a viable alternative especially if the land is priced properly, is near the home unit and contains pollution compliant wintering facilities.
- Leasing of land does not have the risk of high bank debt.

- The stability of leasing is an issue without a long-term lease.
- Income tax is an issue with a high profit lease, as there is a reluctance to invest in facilities on the leased or home farm if a long-term lease is not in place.
- Leasing suits the cash poor dairy farmer who has to borrow to fund livestock and machinery purchases.

Syndicate investment for expansion

Syndicate investments are very popular in the commercial property market, and are now entering the agricultural market in this country. They have been used in other countries for many years. This offers another option for expanding the dairy business. A group of investors come together to invest in a dairy farm business. This can be in any country in the world. The same principles of Return on Investment (RoI) and potential for capital appreciation still apply. It is possible to borrow on the strength of the home farm to fund an investment in the syndicate.

Conclusions

Take home messages for expanding a dairy business:

1. For a dairy farmer considering the expansion of the dairy farm business, it is essential the viability of the plan be assessed before commencement. There are a number of physical, technical, financial and human criteria essential for a successful business expansion.

2. When one buys land there are two distinctly different investments vehicles at play. The first is an investment in the land itself. This is an investment whereby the annual yield or Return on Investment will be low (1-3%), and the investment gain depends on an increase in value over time i.e. capital appreciation. The second is an investment in the farm business itself (i.e. the dairy enterprise). This is an investment whereby the annual yield or Return on Investment is high (8-20%), and capital appreciation is minimal.

3. Buying land for a stand alone dairy unit is suitable for a cash rich investor who is investing for an increase in the value of the property i.e. capital appreciation.

4. Leasing land for a stand alone dairy unit is suitable for a dairy farmer who is borrowing 100% of funds and is investing for gain by realising annual surpluses of cash from a high annual yield or Return on Investment.

5. Leasing land within cow grazing distance is viable for every dairy farmer if they choose to expand.

6. High profit leases require income tax planning.

7. Milk price sensitivity is the critical factor in the expansion of dairy business.

Where for dairy cattle breeding in Ireland?

N. Lopez-Villalobos[1] and D.P. Berry[2]
[1]*Institute of Veterinary, Animal and Biomedical Sciences, Massey University, Palmerston North, New Zealand.*
[2]*Moorepark Production Research Centre, Fermoy, Co. Cork*

Introduction

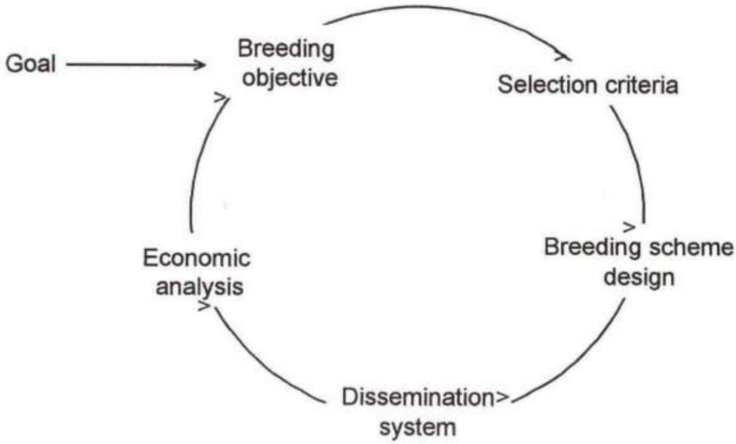
In 2006, there were approximately 1.09 million dairy cows in Ireland distributed among 30,900 herds. Total Irish milk output in 2003, amounted to 5584 million litres. Of the total milk output, 9% was used for liquid milk, 56% for butter/skim milk powder, 20% for cheese, 4% for cream, 5% for whole milk powder, and 3% for chocolate crumb production; 75% of the milk produced was exported accounting for €6.7 billion.

Only 38% of the cows (408,375) and 20% of the herds (6229) in Ireland milk record. The average production for all milk-recorded cows in 2006 was 6723 litres milk, 253kg fat (3.77% concentration) and 226kg protein (3.36% concentration). It is estimated that only 30% of in-calf heifers entering Irish dairy herds are sired by artificial insemination. In New Zealand on the other hand, 71% of the 3.9 million cows (75% of the 11,630 herds) milk record and 73% of cows are inseminated using AI. Similar statistics are evident in other countries.

The Irish Cattle Breeding Federation (ICBF) was established in 1998 with the purpose of re-designing the breeding program for the genetic improvement of dairy and beef cattle accounting for future economic and environmental conditions in Ireland. The breeding objectives and genetic evaluation systems have been reviewed and redeveloped and now the ICBF is focused on the establishment of a breeding program to increase the rate of genetic gain for each breed in Ireland using the best available technologies. The aim of this paper is to describe a systematic approach to the design and enhancement of a breeding program as well as reviewing the current status of the breeding program for Irish dairy cattle and highlighting what components of the Irish breeding program could be enhanced.

A general methodology for the design and enhancement of a breeding program for any livestock enterprise was presented by Harris *et al.*, (1984). This systematic approach was illustrated by Lopez-Villalobos and Garrick (2005) using the breeding program for the genetic improvement of New Zealand dairy cattle as an example (Figure 1). The steps are arranged in a logical sequence starting with the definition of a breeding goal and ending with an economic appraisal of the breeding program. These steps should be repeated iteratively to evaluate various scenarios.

Figure 1. A systematic approach to the design and enhancement of breeding programs



Breeding goal

Definition of a breeding goal is the first step in designing an animal-breeding program. Improvement of dairy cows focuses on directional change in the genetics of cows in coming generations, such that they will produce the desired products more efficiently under expected future economic, social and ecological production environments (Groen, 2000). The direction of the improvement is formalised in the breeding goal that farmers would therefore like improved.

The breeding goal of most Irish dairy farmers is to improve the genetic ability of the cow to generate farm profit. However, there is currently no mention of "environmental sustainability" in the breeding goal of Irish dairy cattle. In the future it's likely that as phrases such as "carbon footprint" and "sustainability" come to the fore, the breeding goal will change to maximising farm profit in an environmentally and socially sustainable manner.

There are different goals for seasonal faming systems where the main limiting resource is pasture grown on the farm. In the case of the New Zealand breeding program the goal has been defined as the genetic improvement of the ability of the dairy cow to transform 4.5t DM feed into farm profit (AEU, 2007).

Breeding objective

Given a goal, the breeding objective can then be formally developed. This involves two somewhat discrete steps. First, the list of traits that influence the goal can be identified. Second, the relative emphasis of each of the traits in the list can be quantified. Depending on the country, the weighting placed on each trait is derived using economics (i.e., Ireland, New Zealand) or desired genetic gains in each trait (e.g., The Netherlands).

Table 1. Economic weights and percentage of emphasis on the various traits included in the EBI in 2008 (Berry et al., 2007)

Sub-index	Trait	€	%	Overall
Production	Milk	-0.09	11	
	Fat	1.26	6	40%
	Protein	6.91	23	
Fertility	Calving interval	-11.97	26	34%
	Survival	11.17	8	
Calving	Calving difficulty, direct	-3.65	2	
	Calving difficulty, maternal	-1.73	1	
	Gestation length, direct	-7.54	4	8%
	Calf mortality	-2.85	1	
Beef	Cull cow	-0.51	2	
	Carcass weight	1.38	7	
	Carcass conformation	10.32	3	14%
	Carcass fat	-11.71	2	
Health	Lameness	1.13	1	4%
	Udder health	-57.21	3	

The economic breeding index (EBI) is a measure of the genetic ability of an animal's progeny to generate farm profit per lactation. The traits and their economic weights in the EBI in 2008 are shown in Table 1. The economic values are derived using the 'Moorepark Dairy Systems Model' (Shalloo *et al.*, 2004) using current costs and future milk prices when land is a limiting factor, as is and will be the case in most Irish farms. Regular revision of the economic values is also a norm to avoid the danger of an outdated selection tool. The EBI will evolve according to changes in farm costs, milk payment and agricultural policies. Future traits that can be considered to be part of the breeding objective are feed conversion efficiency, milk proteins, fat composition and cow traits related to environmental sustainability such as methane and nitrogen (urea) emissions.

Selection criterion

The selection criterion is made up of traits that can be measured on animals and are associated with traits in the breeding objective (i.e., the EBI). Traits included in the selection criteria may be the same or different from the traits in the breeding objective. Traits different to those in the selection, known as indicator traits, are commonly used as they are often easier or cheaper to measure than the objective trait itself or may be measured earlier in life. In the EBI, body condition score, angularity, foot angle and udder depth (scored by the Irish Holstein-Friesian Association), as well as milk yield are used as predictors of goal traits e.g. *calving interval* and *survival*.

Cow fertility is a very important trait accounting for 34% of the emphasis within the EBI. However, calving interval is not an ideal trait as a measure cow fertility because it is lowly heritable (i.e., takes a large amount of information to achieve good reliability), takes a long time to measure, and not all animals (generally the least fertile), re-calve and thereby have no calving interval information. Research is currently underway to utilise the routinely collected insemination and pregnancy diagnosis data to better differentiate between animals for genetic merit for fertility. The system of genetic evaluation for New Zealand dairy cattle produces estimated breeding values for cow fertility which is defined as the genetic ability of the cow to re-calve next lactation in the herd's AI period (Harris and Montgomerie, 2001). Other options, such as the use of survival analysis are also available to better differentiate between animals for survival, which is currently defined in Ireland as the probability of survival to the next lactation.

The national genetic evaluation system in Ireland is conducted across breed using an animal model (Evans, 2007). This system of genetic evaluation allows the simultaneous evaluation of cows and sires using all known relationships and is conducted with a common base for all breeds and crosses. However, such a system of genetic evaluation requires good quality data and statistical models. Connectedness between herds and breeds should exist to correctly estimate breed and heterosis effects. This is achieved by having a significant number of herds with cows of different breeds sired by common sires.

New methods of genetic evaluation have evolved in other countries, and the Irish dairy industry may consider the implementation of some of these, including test-day models and genomic selection. The New Zealand dairy industry implemented a test-day model genetic evaluation for milk production and somatic cell count across breeds and lactations in February 2007. The test-day model evaluation system accounts for differences between cows in lactation persistency (within lactation) and maturity rate (between lactations) and accounts for the environmental effects related to each specific herd-test date. These improvements increase the accuracy of the evaluations, especially for young test sires and cows, resulting in a faster rate of genetic gain for the industry. Greater accuracy is valuable in better identifying superior dams as bull mothers.

Meuwissen *et al.* (2001) described the potential of genomic selection to increase the reliability of estimated breeding values at early age thereby increasing genetic gain. Schaeffer (2006) using parameters from the Canadian dairy cattle population showed that genomic selection can double the rate of genetic progress with a fraction of the costs of running the conventional progeny testing program although it does require a large initial investment. The analysis of Schaeffer (2006) assumed that genomic selection was based on the same traits to those included in the progeny test. Additional gains could be made by incorporating information on traits such as feed conversion efficiency and dry matter intake which are difficult to measure in grazing systems and longevity and fertility that are typically not available with a high degree of accuracy until after selection of bulls for widespread usage.

Breeding scheme

The fourth step of a breeding program involves a sound and transparent structure for the selection of animals of highest estimated genetic merit for the breeding objective; some breeding companies use a different, more futuristic, breeding objective to that used nationally. Reproductive rate of breeding animals and uncertainty about true genetic merit of breeding animals (i.e., the reliability of the estimated breeding values) make up the most important limiting factors in the design of the breeding scheme. The task in designing a breeding scheme is to determine how many, but more importantly, which animals should be selected as parents of the next generation.

A progeny-testing scheme has been the traditional breeding scheme for the genetic improvement of dairy cattle in many countries. The G€N€ IR€LAND progeny testing program was launched in April 2005 as a joint venture involving ICBF and some Irish breeding companies. The aim of the breeding scheme is to progeny test elite young sires under Irish farming conditions, ensuring enough daughters with information to obtain reliable estimated breeding values for traits in the selection criterion. G€N€ IR€LAND is targeting to test annually 100 dairy bulls based on the phenotypic performance of 100 daughters per bull spread into some 700 co-operating herds.

The G€N€ IR€LAND breeding scheme will exploit the four pathways of selection, i.e. cows to breed cows, cows to breed bulls, bulls to breed cows and bulls to breed bulls. Each path differs in the age at which animals are selected (generation interval), the amount of information available for the selection decision (affects reliability of estimated breeding values), the number of animals available for selection and the number of animals selected (intensity of selection).

Selection of bulls and cows to breed bulls involve few animals and potentially there is a risk of reducing genetic diversity and increasing inbreeding in the population. A system of contract mating to generate superior young test sires is currently being developed and is based on optimal contribution theory performing multiple objective optimisation to maximise rate of genetic gain and minimise long term inbreeding.

Annual genetic gain of the national herd for the breeding objective (profit per cow per lactation) over the last 20 years has been low at €2/cow, but the gain in the last 4 years has increased to almost €5/cow. This confirms that the breeding program for the genetic improvement of Irish dairy cattle is being effective although it is far below the theoretical optimum of €20/cow/year.

An efficient progeny testing scheme requires the participation of a large group of motivated dairy farmers and a large scale system to accurately record parentage and productive, reproductive and health events of individual cows along with an efficient system of genetic evaluation. More data are required on health and fertility traits than milk production traits to obtain accurate genetic proofs. However, Irish farmers should not be expected to participate in a progeny testing scheme unless they can be guaranteed that the average genetic merit of the young test sires is superior to that currently available. In Ireland, only a small proportion of cows are inseminated with young test sire semen. This should increase in the future as confidence in G€N€ Ireland gathers.

An alternative to a progeny-testing scheme is genomic selection (discussed previously) or the implementation of a nucleus herd using multiple ovulation and embryo transfer (Nicholas and Smith, 1983). Nucleus herds were designed to reduce the generation interval when compared to progeny testing schemes, and to optimise the use of information on dam, full sibs, half sibs and other relatives to increase the accuracy of selection at early age. Furthermore, nucleus herds facilitate and save large costs on all the logistics of selection and the recording of traits, including those traits that are expensive to measure in commercial farms, such as feed intake and feed conversion efficiency.

Dissemination system

The fifth step of a breeding program considers the design of a system for the efficient transfer of the superior genes from high genetic merit animals, already identified in the breeding scheme, into the commercial population. The choice of the transfer strategy is largely determined by the size of the commercial population and by the cost and efficiency of biotechnologies available such as artificial insemination, multiple ovulation and embryo transfer and sexed semen.

Artificial insemination has remained the main breeding technology in most dairy industries for dispersal of superior genes from high genetic merit bulls into the commercial cow population. The speed with which these genes are established in the commercial population depends on the number of cows inseminated and subsequently calving to the superior bulls. In Ireland only 30% of the calves were from artificial insemination despite the average EBI of stock bulls being €90 lower than the average EBI of the top 20 AI sires (Berry *et al.*, 2005). Furthermore, the reliability of the EBI of the stock bulls is very low (equivalent to that of a young test-sire) implying that the purchase of stock bulls is very much a "luck dip". The low penetration rate of AI in Ireland clearly suggests that more resources (education of farmers) of the breeding program should be dedicated to ensure a significant increase in the percentage of cows inseminated with semen of high genetic merit bulls produced by the G€N€ IR€LAND breeding scheme.

In New Zealand about 75% of lactating cows and less than 10% of heifers are artificially inseminated; the rest of the animals are naturally mated (Livestock Improvement, 2007). These percentages combined with high pregnancies rates at the end of the mating season (about 90%) and low culling rate (22%) ensure that virtually every cow replacement entering the herd is the progeny of a high genetic merit bull.

Farmers in many countries are using crossbreeding as a mating plan to exploit heterosis effects. Under New Zealand grazing conditions crossbreeding effects and breed complementarity can increase profitability for commercial farmers (Lopez-Villalobos and Garrick, 2002). Crossbreeding does not introduce genetic improvement into the population but only exploits the best combination of genes from different breeds. The total economic benefit of crossbreeding effects can be fully exploited through careful planning of selection of breeds and selection of the best individuals within each breed. The best situation for the Irish dairy industry is to use high genetic merit bulls for farm profit (EBI) in a systematic crossbreeding system, but only if the EBI of the sires used are high and if they suit the farming system.

Economic analysis

The last but perhaps the most important step in the design of a breeding program is the economic analysis of the breeding program, which is a very complex exercise only achieved through modeling of the whole breeding program. The simulation must assume that the breeding program is not under the control of the industry, but a result of the collective actions of dairy farmers in concert with economic and genetic aspects of the available genetic material (Garrick and Lopez-Villalobos, 1998).

A difficulty in evaluating the breeding program is the definition of the variables measuring the overall effectiveness of the breeding program. Some variables may be: i) rate of genetic gain in the breeding goal achieved in the commercial population, ii) industry economic benefit considering an integrated industry accounting for all factors affecting farm productivity, factors affecting the processing of milk into dairy products and its commercialisation in the form of dairy products, iii) profit for breeding companies which basically is determined by semen revenue minus the costs of the breeding scheme, and iv) profit for commercial dairy farmers.

The dairy industry must review continuously the breeding programs to evaluate current and futures changes at the farm or industry level. For example, Berry (2007) examined the potential of genomic selection in Irish dairy cattle based on the methodology proposed by Schaeffer (2006); costs of the breeding scheme and industry benefits were compared between some alternative breeding schemes using genomic selection varying the number of animals to be genotyped.

Priorities for the future of dairy cattle breeding in Ireland

The current breeding goal - *profit per cow*, is well defined according to production system and future market conditions. An industry model is currently under development by Moorepark Production Research Centre, (Shalloo *pers. comm.*) that simulates the collection of milk and the processing and marketing of dairy products. This model will be linked to the 'Moorepark Dairy Systems

Model' to calculate economic values for current and new milk traits according to the evolution of the breeding goal and objective as well as quantifying the implications of farmer breeding goals on the processor.

The list of traits considered in the selection criterion is exhaustive but some improvements are required to measure cow fertility. Measuring mastitis instead of somatic cell count will improve the prediction of the cow health, as will the measurement of lameness instead of predicting using locomotion as is currently done. New methods of genetic evaluation considering test-day model or estimation of breeding values using single nucleotide polymorphisms (SNP) are not a priority for the breeding program, there is a need to improve the current evaluation based on an across-breed animal model.

The G€N€ IR€LAND breeding scheme when fully implemented will deliver significant industry benefits captured directly by the Irish dairy farmers. It is of paramount importance that Irish dairy farmers use semen from high EBI bulls tested under Irish conditions. Percentage of cows to artificial insemination need to increase significantly to ensure that cows leaving the commercial herds are replaced by heifers of higher genetic merit. This will reduce the genetic lag between the genetic merit of the bulls and the cow population.

Experimental results comparing strains of Holstein-Friesian cows or breeds (for review see Dillon *et al.*, 2006) across different feeding levels provides information on what type of cow will be the most suitable for the current and future production systems of Ireland. Industry benefit can be evaluated under different usage of straight - and cross-breeding systems, accounting for changes in milk composition and yield of dairy products at the level of the industry, and changes in the management system at the level of the farm.

All these alternative changes in each of the components of the breeding program should be evaluated in terms of the breeding goal and economic analysis. Once a component of the breeding program is modified, the other components have to be evaluated to create a synchronisation with the change introduced and achieve a new optimal stage of the breeding program.

References

Animal Evaluation Unit (2007). Understanding AE. http://www.aeu.org.nz.

Berry, D.P. (2007). Report on the potential of genomic selection in Irish dairy cattle. ICBF Report.

Berry, D.P., Cromie, A.R., Coughlan, S. and Dillon, P. (2005). Objective comparison of artificial insemination and the stock bull in Irish dairy herds. *Technical report to the Irish Cattle Breeding Federation*

Berry, D.P., Shalloo, L., Cromie, A.R., Veerkamp, R.F., Dillon, P., Amer, P.R. Evans, R.D., Kearney, J.F. and Wickham, B.W. (2007). The economic breeding index: a generation on. *Technical report to the Irish Cattle Breeding Federation*. December 2007.

Dillon, P., Berry, D.P., Evans, R.D., Buckley, F. and Horan, B. (2006). Consequences of genetic selection for increased milk production in European seasonal pasture based systems of milk production. *Livestock Science*, **99**, 141-158.

Evans, R.D. (2007). Across breed proofs. ICBF Dairy Industry Meeting. Moorepark Production Research Centre, Fermoy, Co. Cork, 18 Oct 2007 (http://www.icbf.com/publications/files/ICBF_dairy_231107.pdf).

Groen, A.F. (2000). Breeding goal definition. In: S. Galal, J. Boyazoglu and K. Hammond (Eds.) Workshop on Developing Breeding Strategies for Lower Input Animal Production Environments. Bella, Italy. *ICAR Technical Series No 3*, pp. 25-104.

Garrick, D.J. and Lopez-Villalobos, N. (1998). Tomorrow's cows - some kiwi cows of the future. *Proceedings of the Ruakura Farmers' Conference*, **50**, 39-44.

Harris, B. L. and Montgomerie, W.A. (2001). Fertility breeding values for seasonal dairying. *Interbull Bulletin 27*, 139-142.

Harris, D.L., Stewart, T.S. and Arboleda, C.R. (1984). Animal breeding programs: systematic approach to their design. Advaces in Agricultural Technology Agricultural Research Service, USDA. *Bulletin AAT-NC-8*, ARS USDA, Peoria, Ilinois.

Livestock Improvement (2007). Dairy Statistics 2006-2007. Livestock Improvement Corp. Ltd., Hamilton, New Zealand.

Lopez-Villalobos, N. and Garrick, D.J. (2002). Economic heterosis and breed complementarity for dairy cattle in New Zealand. *Proceedings of the 7th World Congress on Genetics Applied to Livestock Production*, Montpellier, France. Electronic communication 01-37.

Lopez-Villalobos, N. and Garrick, D.J. (2005). Methodology for the design and enhancement of genetic improvement programs illustrated in the context of the New Zealand dairy industry. *Agrociencia*, **IX**, 553-568.

Meuwissen, T.H.E., Hayes, B.J. and Goddard, M.E. (2001). Prediction of total genetic value using genome-wide dense marker maps. *Genetics*, **157**,1819-1829.

Nicholas, F.W. and Smith, C. (1983). Increased rates of genetic change in dairy cattle by embryo transfer and splitting. *Animal Production*, **36**, 341-353.

Schaeffer, L.R. (2006). Strategy for applying genome-wide selection in dairy cattle. *Journal of Animal Breeding and Genetics*, **123**, 218-223.

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

Using the EBI: a farmer's perspective

Philip Donohoe
Ballyellen, Goresbridge, Co. Carlow

Introduction

The introduction of the Economic Breeding Index (EBI) to Ireland in 2001 marked a change in direction of the breeding of dairy cattle. Previous indices focused on increasing milk production only, and while successful, the downside was a reduction in fertility. The net result was the cancelling out of any financial gains achieved through increasing milk yield. Poor fertility, if not corrected on farms has the potential to completely wipe out the natural competitive advantage enjoyed by Irish dairy farmers - grass based milk production.

After a slow and troubled start, the EBI with it's inclusion of traits other than milk, e.g. fertility, calving ease, health and beef is now being embraced by farmers' in both spring and winter production systems. Those farmers that have aggressively used the index since its introduction are reaping the rewards of increased profits and easily managed cows.

Farm History

The farm is located one and a half miles on the Carlow side of Goresbridge, a small village on the Carlow/Kilkenny border, and comprises 48.6 adjusted ha. One third of this area is owned and the remainder is leased. It comes in one block, is free draining, and divided into 20 paddocks of varying size and well serviced by roadways and water.

The farm is currently stocked at about 2.4 LU/ha. Quota size is 63,000 gallons of which half is leased. The stock on the farm comprises;

- 70 Cows,
- 50 1-2 year olds (31 replacements);
- 55 0-1 year olds (26 replacements)

Herd History

The dairying enterprise was established in 1969. The breeding policy centred on British Friesian AI bulls available through Dovea, then the only AI service in the area. Among the most commonly used of these were BTR, CPR, COY and LDL.

After completing a DIY AI course in 1996 the variety and volume of bulls available increased dramatically. The glossy catalogues and fast sales talk were impressive and consequently bull choice changed to high RBI, high milk volume and high type. The most heavily used bulls in this period were, HSN, ENM and CAU. While these bulls did deliver on production alas, along with the fancy cows came poor fertility. Before the transition to Holstein, fertility as measured by conception rate and mean calving date was very acceptable. The decline in fertility can be seen in the table below, reaching rock bottom in the 2001/2002 period.

Table 1. Herd fertility following change to high RBI bulls between '96' and '07'

Year	1996	2002	2007
Con. 1st serve (%)	70	43	59
Mean calving	Feb 20	Mar 10	Feb 27

This negative trend in fertility did not go unnoticed and breeding policy was adjusted to include bulls with muscularity and lower volume, e.g. MTY, OMR and JOS. However, it wasn't until 2001 that real action was taken to counteract the fertility problem that was now becoming so evident. A look at bulls being used in New Zealand showed that bulls with high percentages of New Zealand Friesian had much better fertility and survivability traits than bulls of North American Holstein descent. This appeared a very convincing argument that breeding was the best route to rectify this problem and New Zealand Friesian bulls were the ones that were going to do it. That year the bull UYC was introduced and used extensively on the herd.

With the introduction of the EBI later the same year, it served to reinforce the decision to use NZ bulls. They dominated the earlier years of the EBI 'Active Bull' lists. Over the next few years the NZ bulls LYE, SBH, CBH, CWJ and particularly UYC were used. Today 38% of the herd is directly related to UYC.

Over the last three years the focus moved away from NZ bulls, not because of any dissatisfaction with the strain itself but because confidence has grown in the EBI index. Now a bull is not selected based on his strain but on his EBI figures. The bulls RUU, LLO, WLI and KBA have been the most widely used bulls during this last period.

A brief policy of crossbreeding to Rotbunt sires was undertaken during the '03' to '04' breeding seasons. This was not continued as the resulting cows proved very inconsistent with some excellent ones but also some very poor performers. Table 2 shows the different panel of bulls used at different stages and their average EBI.

Table 2. Panel of bulls used and average EBI

Period	Bulls	Average EBI
Pre 1995	BTR, CPR, COY, LDL	48
1996 - 1998	HSN, ENM, CAU	11
1999 - 2000	MTY, OMR, JOS	39
2001 - 2004	UYC, LYE, SBH, CBH, CWJ	109
2005 - 2007	RUU, LLO, KBA, WLI	127

Trends in EBI and profit

Herd EBI has made steady progress since its' introduction in 2001, averaging an increase of €12 per year. Farm profit as decided by common profit/dairy ha appears to be directly linked to EBI movement. Both comparable farm profit and fertility were at their lowest levels around 2002, as was the EBI value. Then as EBI increased so too did profit.

Table 3. Trend in EBI '01' to '07'

Year	2001	2002	2003	2004	2005	2006	2007
EBI (€)	-0.1	?	14	26	41	54	71
Common profit/ha	2529*	2175	2042	2506	2315	2422	?

*2001 shows a high profit but it must be remembered that a high milk price was achieved that year

Current situation

The current production and relevant key performance indicators for the farm can be divided into four categories.

<u>Milk Production</u>

Milk production for 2007 averaged 418kg milk solids per cow. This represents a decline compared with 2006 when milk solids yield per cow averaged 433kg but was due in part to a deliberate policy to increase herd size. In 2007 first lactation heifers accounted for 29% of the herd. Back in 2002 when fertility was a big problem, the herd averaged 375kg milk solids per cow, with similar milk volume yields.

Table 4. Herd performance '97' to '07'

	1997	2002	2006	2007
Milk per cow (l)	5155	4915	5492	4864
MS per cow (kg)	356	375	433	418
Protein (%)	3.25	3.41	3.60	3.66
Fat (%)	3.46	3.99	4.06	4.22

Fertility

Improving fertility performance in the herd means that fewer cows are empty at the end of the breeding season. The fertility data presented in table 5 below excludes information on surplus stock sold and relates to the cows that remained in the herd for the full breeding season in 2007.

Table 5. Herd fertility data

% calved in 6wks	75
Calving interval (days)	366
Empty rate (%)	11
Submission rate (%)	87
Con to 1st serve (%)	59

Financial

Financial data (Table 6) is taken from the 2006 profit monitor (2007 profit monitor not available at time of printing). According to Teagasc reports, the cost and profit results per litre are in the top 1% for spring milk producers in 2006.

Table 6. Financial data (from 2006 profit monitor)

Common profit (c/l)	19.13
Common costs (c/l)	10.07
Cash flow ratio (%)	38
Net worth change (%)	5
Net profit/ha (€)	1,951
Net profit/cow (€)	827

<u>EBI</u>

The herd has an average EBI of €71, which places it just outside of the top 1% of herds in the country which average €72 EBI. It does however compare favourably with the national average of €43 EBI. Table 7 shows the latest EBI proofs for the herd (ICBF, October 2007).

Table 7. Most recent EBI proofs for the Donohoe herd

Group	No.	M (kg) F (kg) P (kg)	F (%) P (%)	Surv (%) CI (Days)	Milk Solids (€)	Fertility (€)	Calving (€)	Beef (€)	Health (€)	EBI (€)
Overall Cows	68	14 6.6 4.4	0.12 0.08	0.9 -2.9	28.7	41.6	10.5	-8.0	-1.70	71
1st Lactation	20	-8 7.4 4.3	0.15 0.09	1.2 -3.6	30.9	51.5	14.1	-11.9	-3.10	82
2nd Lactation	13	-65 2.4 1.8	0.10 0.08	1.5 -3.7	17.4	56.2	8.9	-5.1	-1.70	76
3rd Lactation	11	4 7.5 4.3	0.15 0.08	1.1 -3.3	30.0	47.2	12.3	-10.1	-1.80	78
4th Lactation	7	73 8.2 6.3	0.10 0.08	0.6 -3.0	35.4	38.7	10.7	-10.5	-2.20	72
5th Lactation (+)	17	83 7.8 5.7	0.09 0.06	0.1 -1.4	31.0	16.4	6.2	-3.1	0.10	51
07 Calves	27	51 7.5 5.4	0.12 0.08	1.5 -4.4	32.1	64.0	16.7	-4.3	-0.90	108
06 Calves	32	11 6.3 4	0.12 0.08	1.1 -3.8	26.6	52.3	14.3	-4.8	-2.60	86

Using EBI in the future

To date, the use of the EBI system has delivered results by turning around a serious fertility problem. Farm profits have increased in tandem with EBI increases. Herd value has also increased as high EBI stock are in demand and fetching a premium price. In an attempt to build on these successes, the continued use of the EBI will play a major part in farm decisions. They can be viewed from two perspectives.

Herd perspective

Much of the talk in dairying circles at the moment is centring on expansion. This expansion when it happens, combined with the current shortage of replacement stock, will keep the price of dairy stock at exceptionally high levels for the next number of years. High EBI stock will command a premium in the marketplace and here lies an opportunity to take advantage of the surplus replacements produced on the farm. Selling these replacements would of course prevent on-farm expansion but would deliver similar profit per hectare as milking cows, without the need to provide the capital to pay for quota purchase, parlour improvements and bulk tank which are now operating close to capacity. This replacement enterprise would only be a short term one as the current heifer shortage is rectified. When this happens the farm can then increase its own milking cow numbers (parlour and bulk tank issue will have to be addressed further down the line). By then there should be more clarity regarding quota and land availability. This will aid decisions that need to be made concerning issues such as size and location of parlour.

It is anticipated that the herd EBI milestone of €100 will be reached by 2011. The intermediate herd EBI averages are outlined in the table 8 below. This will be achieved if a replacement rate of 20% is used and the average EBI of the replacements introduced is €120. There is a surplus of replacements available to replace the culls exiting the herd. It is intended to select the highest EBI heifers to replace them. This means that the EBI of the average in-calf heifer entering the herd next spring is €104 and that of the average 2007 born replacement is €124.

Table 8. Predicted intermediate herd EBI average

Year	2008	2009	2010	2011
Expected herd EBI (€)	78	87	94	100

EBI data is also used to measure actual performance of the herd versus genetic potential of the herd. For example the predicted difference for herd protein percentage is +0.08%. According to recent analysis when this figure is multiplied by 4 and add 3.28 to the answer, you arrive at the yearly protein percentage figure that the herd has the genetic potential to achieve, provided management is correct. In this case the genetic potential is 3.60% and the actual achieved on my farm for 2007 was 3.66%. Another example is using the predicted difference for milk volume to estimate response rate to meal feeding. The lower the milk PD the lower the response obtained to concentrates fed.

Bull perspective

To maintain continued progress in herd EBI, it is vital that replacement stock have an EBI value that is well in excess of the herd average. To increase herd EBI by €5 per annum, replacement calves need to be €35 EBI higher than the herd, at a 20% replacement rate. Achieving this requires using bulls that are €70 EBI higher than the herd average. The criteria used for bull selection on the farm are:

- *High EBI:* In order to make progress as outlined above the average EBI of the panel of bulls used on the farm needs to be above €140 EBI, and continuing to rise on a yearly basis. Regardless of the current EBI of a herd, why use bulls of €80 EBI when bulls of €120 or higher are readily available? Use the best.

- *High Fertility sub index:* In seasonal milk production the proportion of cows that go back in calf, and the speed they are got back in calf is critical to the profitability and sustainability of a herd. The economic value put on production is calculated assuming the cow does a 305-day lactation. If fertility is not right, neither is production. To this end, fertility is the single most important selection trait. At some stage economic gain from fertility will level off, when a 365 day calving interval, 90% 6 week calving rate and a 5% empty rate are all achieved. As progress is still required in these areas, a fertility sub index averaging €60 EBI across the bull panel will be required.

- *Milk/Fertility balance:* Output is important in any business. If you don't bring money in, you won't hold on to any of it. As outlined above, fertility is a key driver of production, but by selecting bulls with good milk sub index as well as good fertility sub index there is opportunity to increase milk solid output at no extra cost to the system. A balance that is approx 50/50 milk to fertility is preferred, i.e. bulls with a milk sub index averaging €60.

- *Other traits:* A number or other traits are examined before a bull is finally selected. At least two bulls are selected with good calving sub index for use on heifers, and while it would be nice to have a good calving sub index on all bulls, it is not essential. It is worth noting that there are no hard calving bulls at the top of the ICBF active bull list, where all bull selection takes place. Reliability is not an issue as a panel of bulls are used. Neither is cost, if a bull is going to deliver profit to the farm, the extra semen cost will be returned many times over as genetic gain is cumulative.

Challenges

Very few things in this world are perfect from day one, and the EBI index is no different. It is necessary that it evolve as farmers' requirements change, and as more information becomes available from research. In fact the index should never be fully complete, it must always be ready to react to continual changes. The main challenges facing the industry and the index are:

Supply of bulls

The biggest challenge is to keep finding a continuing supply of new and quality bulls. 2-3 new bulls, with high EBI, suitable to spring calving systems are required every year. The only way to do this is through a clearly defined and focused young test bull programme, such as G€N€ IR€LAND, where the best are bred to the best. Farmers need to use this test semen to create reliability, but they need to be incentivised properly to do this. Getting a few heifers milk recorded free, or coaxing farmers to use test bulls for the good of the industry won't suffice. The incentive needs to come from the young bulls themselves. If the potential EBI of these young bulls are high enough to be right up at the top of the EBI list, farmers will want to use them, without needing to be paid to do so. Add into the mix the requirement for different bloodlines and the challenge escalates. Thankfully pedigree status as a requirement for bull mother selection is not to be continued. The best must be bred from the best, and if the best are non-pedigree they should be used. The purchase of some young bulls each year from outside Ireland should also be considered to overcome the inbreeding challenge, provided of course they have the potential to deliver in an Irish system. The challenge is, can the system produce a steady supply of bulls that are €70 above the herd EBI. The average EBI for the 2008 test bulls in G€N€ IR€LAND is €116 and this falls well short of the requirement of €140!

Weightings of sub index

All predicted economic gain by the EBI is made under the assumption that all animals reach a 305 day lactation. In spring-calving herds, lactation length is much more likely to be below 260 days. This fact alone raises the question 'is too much weighting put on production and not enough on fertility'? Put another way, if days in milk increased through improved fertility then production would also increase, due to improvements in fertility and not because of milk production potential. Fertility in young bulls shows high levels of unreliability. Thus as things stand, if fertility weighting was increased, it would only lead to greater fluctuations in individual bull EBI as reliability increased. Therefore the first challenge is to provide higher fertility reliability at a younger age, and then consider increasing the weighting of the fertility sub index.

Live weight

The introduction of a live weight score to the EBI index has thankfully happened. Research shows that a smaller cow will eat less. It is unfair to rate two cows equally who produce the same milk solids but who vary in live weight. The smaller cow that eats less will have a lower cost of production and consequently leave more profit. This live weight score would then be a negative one.

Beef accuracy

Question marks are immediately raised when one looks at the beef value on bull figures. Tall leggy bulls have positive values and at the other extreme British Friesian bulls have negative values. Yet when these calves are sold in a mart the British Friesian calf will be worth more money than the leggy Holstein.

This index figure is based on carcass weight at slaughter, but should this not be included in an index for the beef farmer who rears the calves and not the dairy farmer who sells the calves? Over the last 12 months, Friesian bull calves sold in the mart at 4-5 weeks of age only made the value of the milk they drank. Therefore it stands to reason that all dairy bull calves are valueless at birth!

Leadership in breeding strategy

There is little or no industry leadership, particularly where alternative breeding strategies is concerned, and consequently much confusion amongst farmers. There is some very solid and positive information coming from the Jersey trial in Moorpark as well as from farmers who have already committed themselves to the Jersey cross route. Yet this is not reflected in the EBI rankings. If Jersey crossbreeding is the most profitable route forward we not only need the researchers telling us that, but we also need the EBI index showing us the same. The challenge is not just to give farmers information, but to give direction in alternative breeding strategies.

Summary

If there is just one message that readers should take from this paper, it is; **EBI WORKS**. In the scenario described above, EBI has *correcting a serious fertility problem; Increasing profit and increasing stock value*. Building on past success and maintaining the momentum is now a real challenge. It is now up to the cattle breeding industry to provide leadership in developing the EBI index, and finding high EBI bulls, to ensure that farmers have the best possible genetics available to increase profitability.

Anthelmintic resistance – a potential crisis for sheep producers?

Barbara Good,
Teagasc Animal Production Research Centre, Athenry, Co. Galway

Introduction

Parasitic gastroenteritis, caused by roundworms (nematodes), is well recognized as a major production-limiting disease, particularly in lambs. Effective parasite control has become heavily dependent on anthelmintics. The development of anthelmintic resistance by roundworms poses a potential crisis for sheep producers and measures to avert and delay this are essential. Results will be presented from recent studies examining anthelmintic resistance of Irish lowland flocks and recommendations to combat the challenges facing producers in controlling parasites will be outlined.

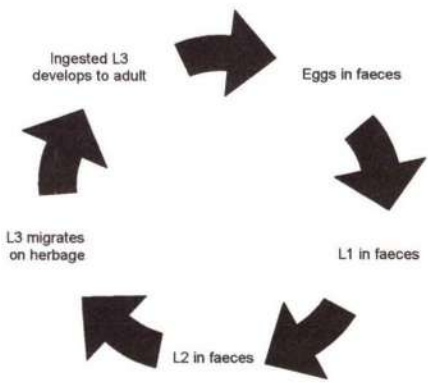
Gastrointestinal parasites

The main roundworms that affect lambs are *Nematodirus battus* in the spring, while later on in the season, a number of other roundworms feature, among which *Teladorsagia* (formerly known as *Ostertagia*) and *Trichostrongylus* species (black scour worm) are the most important. In general, the life cycle of all these gastrointestinal parasites (with the exception of *Nematodirus battus*) is similar (Figure 1). Adult worms in the sheep's gastrointestinal (GI) tract mate and the females lay eggs, which pass out in the sheep's faeces. The egg develops in the faeces and hatches to release a feeding larva (L1 stage). This L1 subsequently undergoes further development to the L2 stage and then to the non-feeding infective stage (L3), which subsequently migrates on herbage awaiting ingestion by a suitable host. Once ingested, the L3s will complete their development to adults (at their preferred sites along the GI tract) within 15 to 21 days, for most common roundworm species. The life cycle of *Nematodirus battus* is slightly different in that development to L3 occurs entirely within the egg and hatching occurs in response to a cold stimulus the following spring. Thus *N. battus* is a parasite that can largely be avoided if grazing lambs on the same pasture each year is avoided.

Anthelmintics

While there are many anthelmintic products on the market that are highly effective against a broad spectrum of roundworm species, they can be grouped based on their mode of action into three classes of compound. All anthelmintics within a particular class work the same way killing the roundworms by starving or through some method that results in worm paralysis. The white drenches (Group I – benzimidazoles and probenzimidazoles such as albendazole, fenbendazole, oxfendazole, mebendazole) affect the energy metabolism of the parasite, which eventually leads to starvation of the worm. Levamisole (Group II) works by interfering with the nervous system (affect the nicotinic acetycholine receptors) of the worm causing muscular spasm and rapid expulsion, while the macrocyclic lactones (Group III such as abamectin, doramectin, ivermectin, moxidectin,) interfere with the worm's nerve transmission by permanently opening ligand-gated chloride channels in the membrane of worm's nerve cells. This leads to inhibition of nerve cells responsible for control of muscles e.g. in the pharynx, body muscle or uterus of the worm causing flaccid paralysis.

Figure 1. Diagram depicting the general life cycle of ovine parasitic roundworms



Anthelmintic resistance

There is no doubt that the advent of broad-spectrum drugs has played a crucial role in diminishing the effects of parasitism in grazing ruminants, and has supported an increase in productivity. However the benefit of this approach is compromised by the parasites developing resistance to these anthelmintics. Wormer resistance is heritable and worms with the genes for resistance have the ability to survive exposure to the standard therapeutic dose of the anthelmintic and thus survive and produce offspring. So over time, with increased anthelmintic use the development of anthelmintic resistance is inevitable as resistant worms become more prevalent in the worm population. Clinical evidence (persistent diarrhoea, lack of thrive) for failed treatment will then become apparent. Resistance can occur within anthelmintic classes (side resistance) and to more than one class of anthelmintic (multiple anthelmintic resistance).

Methods to detect anthelmintic resistance

The most widespread methods used to detect anthelmintic resistance are the faecal egg count reduction test, egg hatch assay and larval development test. The faecal egg count reduction test involves calculating the mean reduction in faecal egg count at a defined interval post treatment (which is dependent on the anthelmintic being tested) for a subgroup of the flock (minimum of 12 to 15 sheep). While this is suitable for testing all anthelmintic groups (Coles *et al.*, 2006) it is only reliable if more than 25% of the worms are resistant (Martin *et al.*, 1989). The egg hatch and larval development assays involves examining the development of eggs and larvae, respectively (from eggs obtained from a pooled fresh faecal samples from a sub group of the flock) in various concentrations of the anthelmintic (Coles *et al.*, 1992; Coles *et al.,* 2006). The larval development test can be used to detect resistance to both benzimidazole and levamisole.

Evidence for anthelmintic resistance

The evidence for nematode resistance to benzimidazoles worldwide is compelling. As yet there is no evidence for anthelmintic resistance in *Nematodirus battus.* The first evidence for resistance to benzimidazole in nematode populations of Irish flocks, was reported by O'Brien (1992), and resistance to levamisole by Good *et al.*, 2003. Results from recent studies in Irish flocks reveal an alarming incidence of anthelmintic resistance to two of the three anthelmintic classes currently available on the market (Good *et al.*, 2003; Good *et al.*, 2006; Patten *et al.*, 2007). Using the faecal egg count reduction tests on 16 farms involved in collaborative projects with Teagasc, resistance to benzimidazole was evident in 94% and to levamisole in 38% of flocks (Figures 2 and 3). Similar results where also observed in a nationwide survey of 64 Irish farms. These farms were representative of lowland producers with a long established enterprise and with a ewe flock size greater than 100. Using the larval development test, 95% and 48% of flocks showed some degree of resistance to the benzimidazoles and levamisole drugs respectively (Patten *et al.*, 2007) (Figures 4 and 5). *Teladorsagia, Trichostrongylus* and *Cooperia* were the main species involved.

Figure 2. Results of faecal egg count reduction test on 16 lowland flocks following benzimidazole treatment (source: Good *et al.*, 2003; Good *et al.*, 2006)

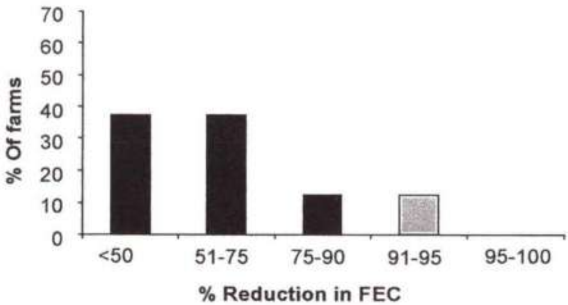


Figure 3. Results of faecal egg count reduction test on 16 lowland flocks following levamisole treatment (source: Good *et al.*, 2003; Good *et al.*, 2006)

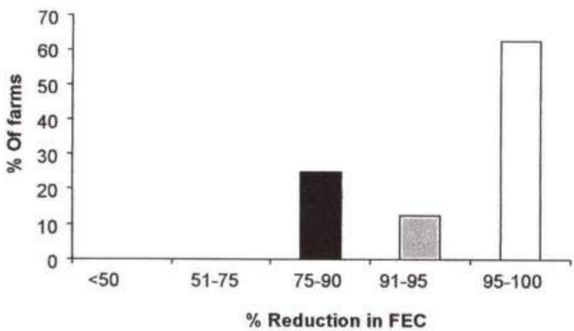


Figure 4. Results of larval development test for benzimidazole of 64 lowland flocks (source: Patten *et al.*, 2007)

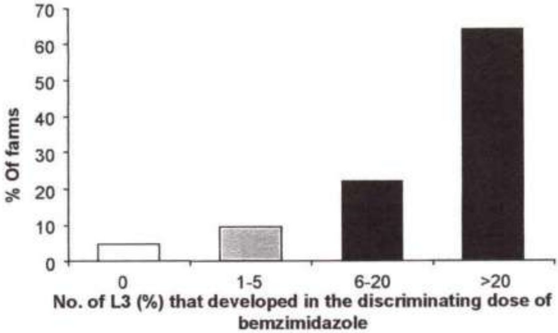
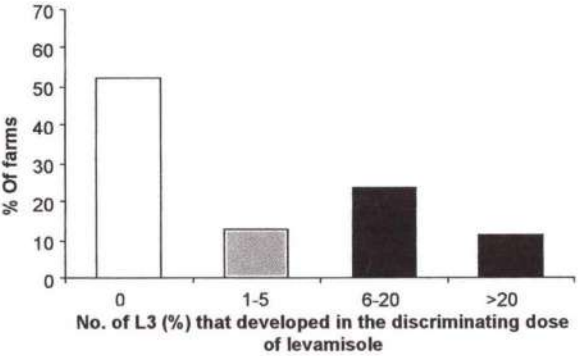


Figure 5. Results larval development test for levamisole on 63 lowland flocks (source: Patten *et al.*, 2007)



The evidence above clearly shows that Irish flock owners need to realise that the development of anthelmintic resistance is in progress on many farms. The development of anthelmintic resistance and its implication for helminth control practice is a serious issue and will impact on animal performance. While research efforts to find new parasiticides are ongoing, it is a sombre fact that no new anthelmintic class for ruminants has appeared on the market since 1981 (McKellar and Jackson, 2004). Currently, there is excitement over a recent report on the discovery of a new class of anthelmintics, namely the amino-acetonitril derivatives (AADs), which have shown considerable promise in being efficacious against a number of livestock roundworms including *T. circumcincta* and *T. colubriformis* of sheep that were resistant to other anthelmintic classes (Kaminsky *et al.*, 2008). As observed in all other classes of anthelmintics, resistance to AADs is possible (Kaminsky *et al.*, 2008). No indication was given when this 'new' class of drug is likely to reach the market but further development of the drug will be necessary (Prichard and Geary, 2008). While this is an encouraging development, it will be some time before such a 'new' product will appear on the market to offset the reduction in efficacy of existing products due to wormer resistance. Even if this product became available tomorrow, a serious effort is needed to preserve and prolong the useful life of existing drugs.

Measures to delay anthelmintic resistance

The development of anthelmintic resistance poses a potential crisis for sheep producers and measures to avert/delay this is essential. In light of this, the fundamental question of how anthelmintic resistance can be delayed has been the subject of much discussion. Against a background of an increasing prevalence of anthelmintic resistance in sheep nematodes on farms in the UK, parasite control measures have been reappraised in order to develop recommendations to slow the development of wormer resistance (Stubbings, 2003; Abbot *et al.*, 2004). The essential actions required to slow the progression of anthelmintic resistance are:

- the effective (proper) administration of anthelmintics
- only use anthelmintics when necessary
- use the most appropriate anthelmintic
- reduce dependence on anthelmintics
- avoid the introduction of resistance onto a farm by treating purchased stock on arrival followed by a quarantine period
- test for anthelmintic resistance (regularly)
- maintain a susceptible population of worms.

As Irish producers are facing the same challenges the recommendations outlined above are relevant here also. These recommendations alongside results from a questionnaire on parasite control practices on Irish farms have been discussed in detail previously (Good, 2005). Essentially, if the underlying principles of delaying resistance namely (a) best anthelmintic practice and (b) strategies that reduce the selection pressure for resistance are adhered to, the emergence of anthelmintic resistance will be minimised.

The future for anthelmintics

Fundamental to sustainable parasite control is a reduction in the reliance on anthelmintics with more effort directed in managing parasites than just the 'treat and forget' approach of the past. The future for anthelmintics in the control of gastrointestinal infections lies in our increased understanding of how anthelmintic resistance develops <u>and</u> the adoption of best anthelmintic practices. This will help to preserve the effectiveness of anthelmintics in controlling the impact of parasites on animal performance.

References

Abbot, K.A., Taylor, M. and Stubbings, L.A. (2004). Sustainable worm control strategies for sheep, A technical manual for veterinary surgeons and advisors. *SCOPS* 43 pages.

Coles, G.C., Bauer, C., Borgsteede, F.H.M., Geerts, S., Klei, T.R., Taylor, M.A. and Waller, P.J. (1992). World Association of Veterinary Parasitology methods for the detection of anthelmintic resistance in nematodes of veterinary importance. *Veterinary Parasitology,* **44**: 35-44.

Coles, G.C., Jackson, F., Pomroy, W.E., Prichard, R.K., von Samson-Himmelstejerna, G., Silvestre, A., Taylor, M.A. and Vercruysse, J. (2006). The detection of anthelmintic resistance in nematodes of veterinary importance. *Veterinary Parasitology*, 167-185.

Good, B. (2005). Anthelmintics – what are you spending your money on? *Irish Grassland Association Journal,* **39**: 1-8.

Good, B., Hanrahan, J.P. and Kinsella, A. (2003). Anthelmintic resistance in sheep roundworms – preliminary observations. *Proceedings of the Agricultural Research Forum,* Tullamore, page 78.

Good, B, Hanrahan, JP, Kelly, W., Glynn, A. and Nally, J. (2006). Evidence for anthelmintic resistance in ewe flocks from Kilkenny, *Teagasc Research Report, Beef and Sheep Production.*

Kaminsky, R., Ducray, P., Jung, M., Clover, R., Ruffner, L., Bouvier, J., Schorderet Weber, S., Wenger, A., Wieland-Berghause, S., Goebel,T., Gauvry, N., Pautrat, F., Skripsky,T., Froelich, O., Komoin-Oka, C., Westlund, B., Sluder, A., and Mäser, P. (2008). A new class of anthelmintics effective against drug resistant nematodes. *Nature*, **452**: 176-180.

Martin, P.J., Anderson, N and Jarrett, R.G. (1989). Detecting benzimidazole resistance with faecal egg count reduction tests and *in vitro* assays. *Australian Veterinary Journal,* **66**: 236-240.

McKellar, Q.A. and Jackson, F. (2004). Veterinary anthelmintics, old and new. *Trends in Parasitology,* **20**: 456-461.

O Brien, D. (1992). Anthelmintic resistance in sheep. *Irish Veterinary News,* 25-26.

Patten, T., Good, B., Hanrahan, J.P. and de Waal, D.T. (2005). A survey of helminth control practices on lowland sheep farms in Ireland. *Proceedings of the Agricultural Research Forum,* Tullamore, 58.

Patten T., Good, B., Hanrahan, J.P., and de Waal, D.T. (2007). A survey of anthelmintic resistance on lowland sheep farms in Ireland. *Proceedings of the Agricultural Research Forum,* Tullamore 128.

Prichard, R.K. and Geary, T.G. (2008). Fresh hope to can the worms. *Nature*, **452**: 157-158.

Stubbings, L.A. (2003). Internal parasite control in sheep. *Proceedings of a workshop to decide short term control strategies to slow the development of anthelmintic resistance in internal parasites of sheep in the United Kingdom.* 11-12th March, Kensington, London 26 pages.

The Irish sheep sector: future prospects in a globalising world

Kevin Hanrahan
Teagasc, Rural Economy Research Centre, Athenry, Co. Galway

Introduction

The Luxembourg Agreement of June 2003 introduced decoupled direct payments into the European Union (EU) Common Agricultural Policy (CAP). From 2005 onwards all incomes from Irish sheep farms have been determined by returns from the market place. Entitlements established over the period 2000-2002 reflect a decoupled single farm payment. The CAP is scheduled for another "mid term review" in 2008 - the "CAP Health Check". The widely leaked text of the Commission's proposals (Agra-Europe 2008) indicates that in contrast with the previous "review" which introduced decoupling to the CAP, the Health check will be much more modest in ambition (with the exception of reforms to the milk quota). The possibility of an agreement in the agriculture negotiations that form part of the World Trade Organization's (WTO) Doha Development Round is likely to be of more importance in the medium term.

In this paper Baseline projections from the FAPRI-Ireland model on the evolution of the Irish sheep sector in terms of animal numbers, volume of lamb produced, prices and value of sector output, are presented together with an analysis of the impact of a possible WTO agreement. The impact on the Irish sheep sector of developments on international agricultural markets, and of other policy and market changes related to climate change is also discussed.

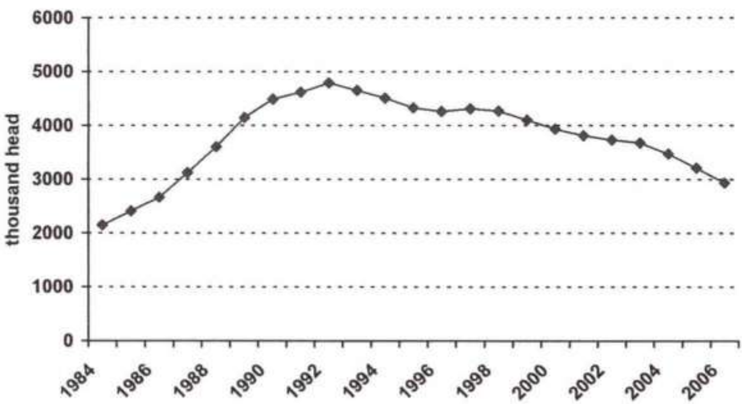
Luxembourg Agreement revisited

Under the terms of the Luxembourg Agreement (EC, 2003), Ireland chose to fully decouple direct payments from production from 2005 onwards. The decoupling of direct payments at the time was expected to lead to a dramatic change in Irish and EU livestock production. Binfield *et al.*, (2003) projected that as the returns from cattle and sheep production declined with the decoupling of the direct payments, Irish suckler cow and ewe numbers would, by the end of 2006 decline to less than 1 million and 3.2 million head respectively.

For a number of reasons (economic and non-economic) the decline in suckler cow numbers has not transpired. December 2006 suckler cow numbers were still over 1.1 million. Breen *et al.*, (2007) suggest some reasons why the expected decline in suckler cows has not occurred. They suggest that satisfaction of the cross-compliance criteria associated with receipt of the single farm payment necessarily involves incurring some direct costs, and that since over-head costs have to be met regardless of production decisions, that for the majority of cattle farmers the decision to continue to farm post-decoupling may be economically rational.

In contrast to the seeming absence of a supply response to decoupling in the beef sector, the decoupling of the ewe premium has coincided with a large decline in the Irish ewe flock. Since the end of 2003 Irish ewe numbers have declined by more than 20%. All of the decline in the Irish ewe flock over this period should not be attributed to the decoupling of the ewe premium since the flock has been in decline since 1992 (Figure 1). However, in all probability the decline in ewe numbers since 2003 has at least in part been due to the decoupling of the ewe premium, which reduced the returns to time spent farming sheep, as off-farm labour returns increased. The divergence in the supply response on cattle and sheep farms has not yet been fully explained but may be due to the different demographic characteristics of sheep and cattle farmers and the higher investment costs of running a sheep enterprise on a part-time basis.

Figure 1. December ewe numbers



Source: CSO *December 2006 Livestock Survey*, April 2007 and CSO (2008) *EIRESTAT* database.

In comparative terms, over the period 1999-2005 the gross margins of sheep enterprises from the National Farm Survey (NFS) have been higher than those earned from cattle enterprises. In Table 1 the average gross margins per hectare of the top 25% of farms (when ranked by margin per hectare) in mid-season lamb production are compared with average gross margin of the top 25% of different cattle enterprise margins. As is clear from Table 1 the margins achieved from better sheep enterprises consistently exceed those achieved by the better cattle enterprises.

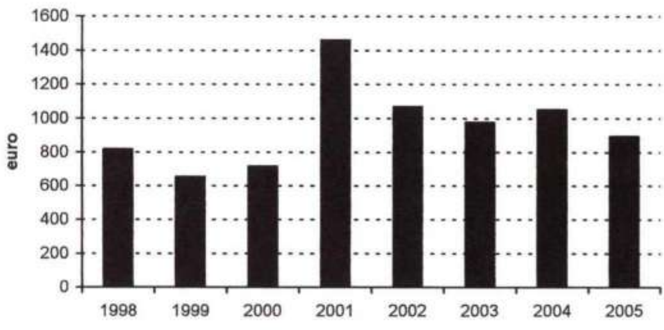
Table.1 Comparative gross margins in cattle and sheep enterprises

	1999	2000	2001	2002	2003	2004	2005
Mid Season Lamb	625	716	1544	1180	1094	1211	1054
Single Suckling – Calves to Weanlings	375	565	929	853	866	835	706
Single Suckling – Calves to	374	484	730	844	694	763	675
Single Suckling – Calves to	399	625	816	935	838	1030	974
Weanling and/or Stores to	487	513	945	937	725	935	1060

Source: NFS as published in Teagasc Management Data for Farm Planning, various issues
Note: Average margins are not weighted reported are not weighted by population weights and consequently will differ slightly from margins reported by NFS enterprise analysis.

The real value of the margins earned from sheep enterprises in the National Farm Survey sample are graphed in Figure 2, where the nominal values of the gross margin for the mid-season lamb enterprises is deflated by a GDP deflator with the year 2000 as its base year. Figure 2 clearly shows that margins per hectare, when expressed in real terms, have increased over the period 1998 to 2005. Analysis of NFS enterprise margins data for 2005 and 2006 also indicates that on a hectare basis, margins on mid-season lamb enterprises are lower than in 2005 but still higher in real terms than margins achieved in or prior to 2001 (NFS 2006, NFS 2007).

Figure 2. Real gross margins per hectare – mid-season lamb (soil one)



Source: Own calculations

Policy and market prospects for agriculture

Climate change and bio-fuels

Climate change can be expected to affect agricultural markets including those for sheep and sheep meat in a number of direct and indirect ways. Some of the impacts of climate change on production in different parts of the world will have direct consequences for sheep markets; other impacts will be indirect and will be the result of policy and other responses to the climate change problem. In the medium term indirect impacts may be more important than the direct ones.

The recent droughts in the southern hemisphere may or may not be caused by global warming, but if their increased frequency is a result of global climate change then the role of countries such as Australia as a major producer of temperate agricultural commodities will be negatively affected. The recent droughts have positively affected prices for dairy commodities and grains in Australia (and internationally). In the short term, the same weather shocks had the opposite impact on sheep and cattle prices; as herds and flocks were liquidated during the drought as prices fell (Drum *et al.*, 2007; Fetcher *et al.*, 2008). Over the medium term (assuming average climactic conditions) Australian livestock prices are expected to recover as breeding inventories of cattle and sheep are rebuilt. If climate change were to cause a permanent and negative shift in agronomic conditions in countries such as Australia then international lamb prices together with prices for many other temperate agricultural commodities would be expected to increase.

Such permanent climate driven developments are still uncertain and may (or may-not) arise in the future. However, in contrast to such direct impacts, the indirect impacts of climate change are already being felt. In response to the problem of climate change, policies are being considered and introduced that have already or will in the future affect Irish sheep producers.

Internationally the growing of crops to produce bio-fuel is increasing, and becoming more and more controversial. Even if the bulk of scientific opinion shifts to the no-side in the debate on the environmental benefits of first generation bio-fuels, their production is likely to continue into the near to medium future.

The bio-fuel demand for crops (grains and oilseeds) has contributed in recent years to the growth in international prices for these commodities, though much of the observed growth is also due to other supply and demand factors. Other things being equal the emergence of this industry and its support by taxpayers and consumers through either direct subsidies as in the US or via mandatory inclusion rates in petrol and diesel as in some EU countries, increases the prices of most animal feed ingredients. The negative impact can, depending on location, be offset by increased availability and lower prices for distillers' grains and oilseed meals. On balance, however, it is probable that bio-fuels by increasing feed costs, improve the competitiveness of Irish sheep production versus continental EU competitors who have a greater reliance on concentrates while also increasing the price competitiveness of lamb versus other meats (beef, pork, and poultry meat) whose production systems are more reliant on grain and oilseed based feeds than lamb production.

Bio-fuels represent one of the policy responses to climate change that has the potential to affect agriculture and the sheep sector in particular. However other specific climate change policies could have more of an impact. Agriculture in Ireland contributes over a quarter of Ireland's green house gas emissions, and within agriculture, ruminant animals are the most important source of green house gases. It is conceivable that polices could at some time in the future be introduced that would seek to reduce Irish agriculture's contribution to green house gas emissions. Such policies range from carbon taxes to cap and trade schemes. Within the context of Irish agriculture's green house gas emissions, the sheep sector is a relatively small contributor when compared with the cattle and dairy sectors. However, polices introduced in Ireland that attempt to reduce emissions from agriculture would likely to have some negative affect on Irish sheep production. If similar policies were introduced at an EU or at a wider international level the negative impact on the competitiveness of Irish agriculture and Irish sheep production would be ameliorated.

CAP health check

The upcoming CAP Health Check proposal from the European Commission has been widely leaked (see Agra-Europe for a summary). Given that Ireland has fully decoupled all direct payments for the sheep sector, the most important proposals (other than those relating to reform of the milk quota system) are for increased rates of modulation of single farm payments and the possibility of changing from the historic model applied in Ireland towards a regional flat area payment model similar to that used in Germany.

For farmers with single farm payment entitlements greater than the €5,000 franchise, the modulation proposal will entail a loss of farm income. On average, farmers (both full and part-time) whose farm business is classified by the NFS as "mainly Sheep" have SFP entitlements in excess of the €5,000 franchise and will lose out if the increased rates of modulation are agreed.

The Commission's proposals on moving towards a flat area payment model is that countries would be *allowed* to do this rather than be *required* to do it. This is an important point since it allows member states such as Ireland who currently apply the historical model to maintain the *status quo*. On farms classified as "Mainly Sheep" by the NFS, single farm payment entitlement per hectare are lower than on any other farm type, and sheep farmers would probably (on average), benefit from a change to a flat area payment system. Shresthra *et al.*, (2007) analysed the implications of a move to a flat area payment system and concluded that sheep farms would benefit, but that since such a change affects farm income as opposed to enterprise margins, production decisions would not be significantly affected.

Given the potentially large re-distributive impact of a move to a flat area payment system, its introduction in Ireland is unlikely in the near term. In the medium to longer term however, as the political justification for basing single farm payments on production decisions taken in the period 2000 to 2001 wanes and the so-called public good justification for payments to farmers gain credence the pressure for a flat area payment system in Ireland and other countries will increase.

WTO

The ongoing WTO negotiations in Geneva at the time of writing (mid-April 2008) are still unresolved. A further revision of the agriculture negotiations' Chairman Ambassador Crawford Falconer's February 2008 modalities paper (WTO, 2008) is expected by the end of April. A mid-May WTO Ministerial meeting, at which political decisions concerning the talks would be taken, is being mooted but is as yet not confirmed (ICSTD, 2008).

Arguably the biggest stumbling block to an agreement on the agricultural modalities are problems in agreeing an equivalent paper for reforms to the rules governing trade in non-agricultural goods, or NAMA (non-agricultural market access) in WTO jargon. Currently large and competitive exporters such as Brazil and India are unhappy with the "rate of exchange" between the agricultural market access offered in the agricultural negotiations and the increased access to their markets for non-agricultural goods demanded by developed counties such as the EU and the United States. Countries such as the EU and the US are similarly "unhappy" that the rate of exchange in the opposite direction is too high, i.e. too much agricultural market access is being demanded for too little in terms of increased market access for non-agricultural goods.

It is difficult at this point in time to predict whether or not a political agreement will be reached before the electoral timetable in the United States effectively rules out the possibility of an agreement in 2008. If no agreement is reached this year, the process will effectively be put on hold. It is almost certain, however, that when negotiations resume they will begin from where they left off in 2008, which will be close to where the current draft modalities paper lies.

The current draft modalities paper proposes liberalising reforms across the 3 key areas of negotiations: market access, export competition and trade distorting domestic support to agriculture. These are the so-called *three pillars* of the negotiations. The current modalities text (since it is still the subject of negotiations) contains a number of areas in which what will or might finally be agreed is uncertain. However for a number of the key trade policy instruments, ranges for the tariff cuts that might be agreed, the schedule for the elimination of export refunds and cuts in government support for agriculture are specified in the text. Key areas of continuing disagreement within the agriculture negotiations involve issues relating to the designation of product as sensitive, special and differential treatment for less developed economies, and the impact of the trade reforms on tropical commodities.

The current draft modalities paper envisages cuts of between 66 and 73% in the tariffs that protect EU agricultural commodity markets, that export subsidies be eliminated by the end of 2013 (with a cut of 50% in 2010), and that overall trade distorting domestic support be reduced by 70% from bound levels. The current draft also allows WTO members to designate between 4 and 6% of tariff lines as "sensitive products". What such a designation means is that the tariff cut required could be reduced by up to only 1/3 of what it would otherwise be. Such designation would however come with the requirement to expand tariff rate quota (TRQ) for the products designated as sensitive by an amount equal to between 4 and 6% of total domestic use of the product concerned.

The technical details of the sensitive product designation in particular are still a matter for negotiation and controversy (ICSTD, 2008), and could potentially limit the extent to which a WTO agreement would negatively affect EU agricultural commodity markets. However the number of lines that can be designated as sensitive is limited to between 4 to 6% of the more than 2000 tariff lines for agricultural and food products. For some products the TRQ expansion that would result from sensitive product designation could be "as bad" in terms of the increased market access afforded as the non-sensitive product designation.

FAPRI-Ireland baseline and WTO scenario analysis

FAPRI-Ireland is currently undertaking analysis of the impact of possible outcomes of the WTO Doha Round of negotiations. Previously published studies (Binfield *et al.*, 2006) examined the impact of the current EU within the WTO negotiations (European Commission, 2005).

The FAPRI-Ireland model has over the last 10 years been used to analyse the impact of successive CAP reform proposals and agreements, and has also been used to analyse the impact of WTO reform. In conducting this type of analysis it is necessary to construct a counter-factual simulation in which the policy change being considered does not take place. In the methodology employed by FAPRI-Ireland, this simulation of a future where current policy remains unchanged into the future (the Baseline), effectively acts as the experiment control. The impact of the policy change being analysed is the difference between the simulated outcome when the policy change is introduced (the scenario) and Baseline.

Under the current FAPRI-Ireland Baseline (Binfield *et al.*, 2008a) agricultural policies currently in place are held constant. These policies incorporate all the details of the CAP agreed in the Luxembourg Agreement of 2003 and allow for the differential implementation of that agreement. Thus all Agenda 2000 direct payments are decoupled in Ireland. The new 'suckler cow' welfare scheme payment, financed by the Irish exchequer is implemented. International trade rules agreed in the Uruguay Round of the GATT are assumed to hold for the entire projection period. Forecasts of macroeconomic variables such as rates of inflation, population growth, per capita incomes and currency exchange rates are obtained from the ESRI and Global Insight Inc. (an international macroeconometric forecasting firm.

Baseline results

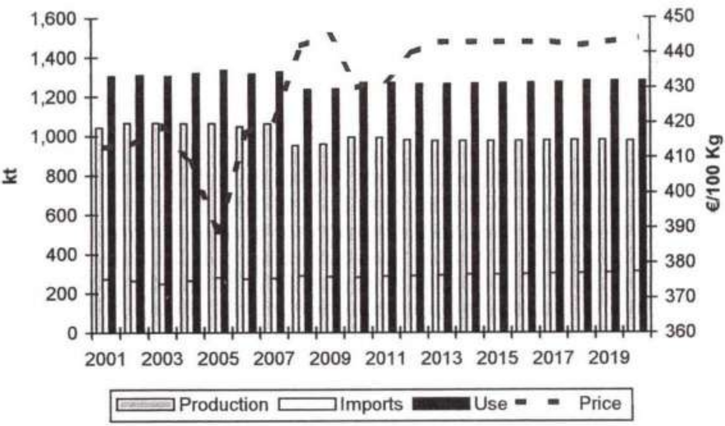
Under the Baseline simulation, the contraction in EU sheep production observed since early 1990 is projected to continue. In most EU Member States, the ewe premium was fully decoupled and this is projected to lead to a continuation of the decline in the EU ewe flock. Ewe numbers in the EU are projected to decline by almost 8% between 2007 and 2020. The decline in ewe numbers is largely matched by a decline in sheep meat production, which between 2007 and 2020 is projected to decrease by over 8%.

EU domestic sheep meat consumption is also projected to decline over the Baseline period, with total EU domestic use in 2020 almost 4% lower than in 2007. This decline in is due to declining per capita consumption of lamb across the EU, which results from projected increases in lamb prices. Per capita consumption is, by 2020, projected to be over 6% lower than in 2007. By 2020 EU sheep meat prices are projected to be over 5% higher than in 2007.

Under the Baseline simulation, production of sheep meat in the EU declines at a greater rate than domestic use. To fill the increasing gap between EU production and consumption of lamb, EU imports are projected to increase. By 2020 EU imports of sheep meat are projected to be over 12% higher than in 2007. From 2010 onwards EU imports of lamb are projected to be in excess of the EU TRQ for lamb, with all over-quota imports paying the full tariff that comprises of a customs duty of 12.8% plus a specific tariff that on average is over €200/100Kg.

The price outlook for the Irish sheep sector is largely determined by the prospects on its export markets. Under the Baseline, Irish lamb prices are projected to increase from the levels observed in 2007, with the 2020 price level projected to be almost 7% higher. Figure 3 illustrates the projected Baseline supply and use balance, and sheep meat prices on the EU market to 2020.

Figure 3. Baseline EU sheep meat supply and use balance



Source: Binfield et al., (2008a).

Under the Baseline, the Irish ewe flock is projected to continue to decline. Over the period 2000 to 2007 the ending stocks of ewes in Ireland declined by almost 26%. Between 2007 and 2020 the rate of decline in ewe numbers is projected to slow considerably. The Irish ewe flock is projected to decline by a further 9% over the projection period 2007 to 2020, so that by 2020 ending stocks of ewes are 2.8 million head. This compares with an ending stock of ewes in 2000 of over 3.9 million head.

The reduction in ewe numbers is not matched by reduced lamb slaughter. Under the Baseline, average productivity per ewe, in terms of lambs weaned, is expected to be higher on those farms remaining in sheep production. As a result, by 2020, the volume of sheep available for slaughter declines by only 9%. The percentage change in total sheep and lamb slaughterings between 2007 and 2020 indicates a more dramatic reduction of over 15%, with the difference between the percentage change in lambs available for slaughter and total sheep slaughtered due to the high rate of ewe slaughter observed in 2007. Over the projection period, the high levels of ewe slaughter observed over the last 7 years are not projected to continue.

Lower slaughter and largely unchanged average slaughter weights mean that under the Baseline the volume of Irish lamb production is projected to decline by approximately 15% between 2007 and 2020.

Irish domestic use of lamb is projected to increase by more than 9% over the Baseline projection period 2007-2020. The increase in total domestic use of sheep meat in Ireland is entirely due to strong population growth that is sufficient to offset the projected decline of over 6% in per capita consumption of sheep meat. With increased domestic use and projected declines in production, Irish exports of lamb decline under the Baseline. By 2020 Irish lamb exports are projected to be over 23% lower than in 2007.

The value of the sheep sector's output at producer prices (inclusive of the value of changes in stocks) in 2020 is projected to be more or less equal in nominal terms to that observed in 2007. The projected increase in lamb prices of 7% over the Baseline period, and the projected slow down in the rate of decline of sheep stocks are sufficient to offset the impact of the reduction over the Baseline projection period in the volume of lamb produced.

Implications of a WTO agreement for the Irish sheep sector

In the analysis conducted of the impact of a WTO reform on the Irish sheep sector, lamb is not designated as a sensitive product. There have been calls for lamb to be given this status in the event of an agreement being reached. Future analysis may examine the impact of lamb being designated a sensitive product (however at the moment it looks politically unlikely that lamb would get such status).

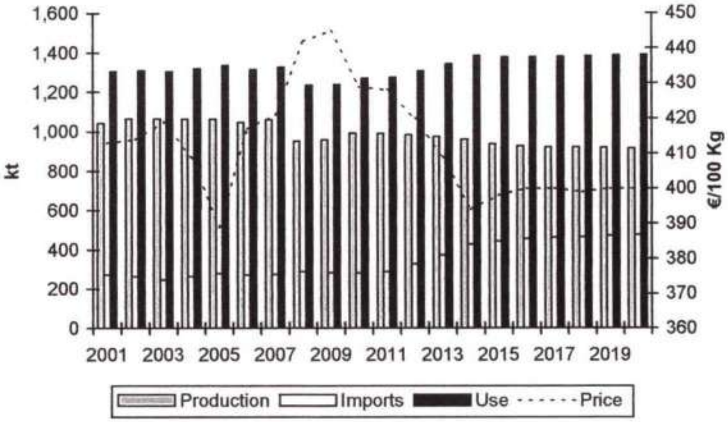
Under WTO reform scenarios analysed, the tariffs imposed on imports of lamb in excess of existing TRQ are cut over a 4 year period from 2010 onwards by 70%. Existing TRQ are not expanded since lamb is not designated as a sensitive product. The elimination of export subsidies does not directly affect the lamb sector since the EU is expected to remain an importer rather than an exporter of lamb.

Under the WTO scenario analysed, EU lamb imports in 2020 when compared with the levels projected under the Baseline, are expected to be over 55% higher. By 2020 EU lamb imports are expected to account for almost 35% of EU lamb consumption. With the large increase in imports projected over the period 2007-2020 under the WTO scenario, EU market prices are projected to decline, with lamb prices in 2020 projected to be 10% lower than under the Baseline.

Lower market prices for lamb, under the WTO reform scenario analysed reduces the economic incentives to produce lamb. Ewe numbers, by 2020, are projected to be over 5% lower than under the Baseline. EU lamb production is projected to be over 6% lower in 2020 when compared with the Baseline level in that year. Figure 4 illustrates the projected supply and use balance for lamb and lamb price under the WTO scenario analysed.

As under the Baseline, the prospects for the Irish sheep sector under the WTO scenario are determined by the evolution of the internal EU market balance for lamb and the associated lamb prices on our export markets. As a result of the dramatic increase in EU imports of lamb that are projected to occur with a WTO reform, Irish prices under the WTO scenario are projected to decline by almost 11%. The decline in Irish lamb prices relative to the Baseline leads to a reduction in the returns to lamb production and a consequent reduction in Irish ewe numbers and Irish lamb production.

Figure 4. WTO EU sheep meat supply and use balance



Source: Binfield et al., (2008b).

By 2020, under the WTO reform scenario analysed, Irish ewe numbers are projected to be 8% lower than under the Baseline. Irish production of sheep meat is also projected to decline by approximately 8% relative to the Baseline. With lower lamb prices, Irish consumption of lamb is projected to increase by over 2% by 2020 relative to the Baseline.

Lower volumes of output and lower prices combine to dramatically reduce the value of output produced by the Irish sheep sector under the WTO scenario. By 2020 the value of output at €121 million is projected to be almost 18% lower than under the Baseline.

The large cut in the tariffs imposed on lamb imports into the EU, under the WTO reform scenario leads to a dramatic increase in the available supplies of lamb on EU markets. The FAPRI-Ireland model and the models to which it is linked are non-spatial models. As such they are not able to project from where the increase in EU import is sourced. However, given that New Zealand currently supplies the vast majority of EU lamb imports, it is likely that any increase in EU lamb imports will largely be met from New Zealand and perhaps from increased supplies from Australia.

It is not clear whether or not New Zealand and Australia would have the capacity to supply such a large increase in the absence of very significant increases in lamb prices relative to dairy prices. The projections from the Australian Bureau of Agricultural and Resource Economics (ABARE) indicate that by 2013 Australian lamb production would still be less than the pre-drought levels (Fletcher *et al.*, 2008; Drum *et al.*, 2007). The latest forecast from the New Zealand Ministry for Agriculture and Forestry (MAF-NZ, 2007) show that

New Zealand lamb exports in 2011 would be 11% lower than in 2007. The latest OECD-FAO Baseline projections for lamb production in Australia and New Zealand foresee increases in production between 2016 and an average of the period 2004-2006 of 8 and 3% respectively (OECD-FAO, 2007).

While these baseline projections, by assumption, have not accounted for the positive impact of a WTO agreement on New Zealand and Australian lamb prices, the relative competitiveness of lamb versus other agricultural commodities (most notably dairy commodities), is likely to constrain the positive supply response one could expect. The projected surge in EU lamb imports projected by the FAPRI-Ireland model and the consequent decline in internal EU lamb prices may possibly overstate the impact of the trade reform analysed. The capacity of New Zealand and Australia to supply significant quantities of lamb to the EU if tariff barriers were lowered significantly by a WTO agreement, remains an issue that would benefit from further analysis.

Conclusion

Given the current state of international food markets, with high and increasingly volatile prices seemingly here to stay, the analysis presented in this paper may appear unduly pessimistic. Readers should remember that for most agricultural commodities, world prices are still considerably lower than EU prices, so that even with the dramatic increases in world price levels currently reported in the media, EU prices are for the most part still higher. This means that tariff cuts will still "hurt", though the higher world prices go the less any given tariff cut will undermine internal EU prices.

The importance of marketing support for lamb and of producing products that are tailored to consumer requirements will remain and arguably increase in importance. Consumption of lamb within the EU has been in decline as it has lost price competitiveness against other meats. A small turn around in the per capita consumption of lamb could yield enormous benefits in terms of price and returns to production. To achieve such goals the product delivered (lambs) will have to be such that marketing campaigns supported by organisations such as Bord Bia (stressing the healthy attributes of lamb) can have a chance in succeeding.

Keady and Hanrahan (2006) conclude that pre-farm gate efficiencies of up to 66c/Kg are possible from improvements in the genetic merit of sheep flocks farmed, grassland management, winter-shearing and the use of high quality grass silage. On the basis of the analysis of the impact of a WTO agreement on the EU and Irish agricultural markets reported here, such efficiencies will be essential to maintain profitability in Irish sheep production. To improve the profitability of sheep production in the medium to long term (where a WTO reform close to that analysed in this paper is highly probable) will require the continuous development and adoption of new technologies and farming methods that lower the costs of production. Changes to the structure of Irish livestock farming, that will allow it to compete with southern hemisphere producers, will probably also be required.

A WTO agreement may not happen in 2008. Future or restarted WTO negotiations may occur within an environment where there are heightened and more politically acknowledged concerns relating to global climate change and global food security. Nevertheless, notwithstanding the possible incorporation of some non-trade concerns within a future trade reform agreement, a WTO agreement along the lines being currently negotiated in Geneva is highly probably within the next 10 years. Irish farming and Irish sheep farming will face a new and major challenge in the years ahead as a result.

References

Agra-Europe (2008). Health check special: details of Commission draft proposals. *Agra-Facts* No.19-08, February 28th, 2008.

Binfield, J., Donnellan, T., Hanrahan, K. and Westhoff, P. (2003). The Luxembourg CAP reform agreement: implications for EU and Irish agriculture. In: *The Luxembourg CAP Reform Agreement: analysis of the Impact on EU and Irish Agriculture.* FAPRI-Ireland Partnership, Teagasc, Dublin.

Binfield, J., Donnellan, T., Hanrahan, K. and Westhoff, P. (2006). World agricultural trade reform and the WTO Doha development round: analysis of the impact on EU and Irish agriculture. FAPRI-Ireland Partnership, Teagasc.

Binfield, J., Donnellan, T., Hanrahan, K. and Westhoff, P. (2008a). Baseline 2008 Outlook for EU and Irish Agriculture. *Unpublished.*

Binfield, J., Donnellan, T., Hanrahan, K. and Westhoff, P. (2008b). Impact of WTO Agreement on EU and Irish Agriculture. *Unpublished.*

Breen, J., Hennessy, T. and Thorne, F. (2007). *FAPRI-Ireland Baseline 2007: Farm level analysis.* Teagasc.

CSO (2007). *December 2006 Livestock Survey.* Central Statistics Office, Cork.

CSO (2008). *Eirestat Database.* Central Statistics Office, Cork. Online at www.cso.ie/px/pxeirestat/database/eirestat/eirestat.asp Accessed April 15, 2008.

Drum, F., Shaw, I., Wood, A., Ashton, D. and Lindsay, P. (2007). Outlook of beef and veal, sheep meat, pigs and poultry to 2011-2012. *Australian Commodities*, **14 (1):** 62-72.

European Communities. (2003). Council Regulation (EC) no. 1782/2003 of 29 September 2003 establishing common rules for direct support schemes under the common agricultural policy and establishing support schemes for farmers. *Official Journal of the European Union*, L270: 1-69.

European Commission. (2005). Statement of EU conditional negotiating proposals – with explanatory annotations. Brussels, 10 October, 2005. Available to download at http://europa.eu.int/commission_barroso/mandelson

Fletcher, S., Fell, J. and Hogan, J. (2008). Meat Outlook to 2012-13. *Australian Commodities*, **15 (1):** 76-98.

ICSTD. (2008). Agriculture: positions harden on special products, special safeguard mechanism. *Bridges Weekly Trade News Digest*, **12(13)**

Keady, T. and Hanrahan, S. (2006). Efficient sheep production in a subsidy free environment – Research from Athenry. *Annual Journal of the Irish Grassland Association*, 2006.

MAF – NZ. (2007). *Situation and Outlook for New Zealand Agriculture and Forestry*. New Zealand Ministry of Agriculture and Forestry, Wellington.

OECD-FAO. (2007). *OECD-FAO Agricultural Outlook 2007-2016*. OECD, Paris, France.

National Farm Survey. (2006). Sheep enterprise analysis 2005. Mimeo, Teagasc.

National Farm Survey. (2007). Sheep enterprise analysis 2006. Mimeo, Teagasc.

Shresthra, S., Hennessy, T. and Hynes, S. (2007). The effects of decoupling on farming in Ireland: A regional analysis. *Irish Journal of Agricultural and Food Research*, **46**: 1-13.

Teagasc. *Management Data for Farm Planning*. Annual, various issues.

WTO. (2008). Revised draft modalities for agriculture. World Trade Organization, Committee on Agriculture, Special Session. TN/AG/W/4/Rev.1. World Trade Organization, Geneva.

Report on the future of the sheep and goat sectors in Europe

Liam Aylward
MEP

Issues to be addressed

1. The sheep and goat sectors in the EU are important traditional farming enterprises, that support the livelihood of thousands of producers, thereby serving to underline its socio-economic contribution in rural areas of the EU

2. Sheep and goat farming play a key environmental role that includes the natural upkeep of less fertile areas and the preservation of sensitive eco-systems.

3. The sheep and goat sectors in the EU (which are concentrated in less favoured areas), are witnessing a critical decline in production and an exodus of producers.

4. The sheep and goat sectors in the EU are characterised by low producer incomes, falling domestic production, declining consumption and are exposed to increasing international market competition;

5. The systems of sheep and goat production in Northern and Southern Europe are significantly different.

6. EU lamb does not have meaningful access to the EU agricultural promotion budget and is in need of a sustained promotional campaign to develop consumer preference

7. The upcoming CAP 'Health Check' provides the opportunity to address the relevant policy instruments and CAP support for the sheep and goat sectors.

Summary report recommendations

1. Acknowledges the urgent need for action to be taken by the European Commission (EC) and the EU Agriculture Council of Ministers to halt the decline in sheep and goat production in Europe, and advocates the maintenance of these traditional, eco-friendly farming enterprises and a Community supply base of EU lamb.

2. Notes the intention of EC to review policy instruments where it has been demonstrated that decoupling has had a negative impact, and welcomes further

reference to this specific issue in the context of the recently published EC CAP Health Check communication.

3. Calls on the EC and the EU Council of Agriculture Ministers to direct additional financial support as a matter of urgency to EU sheep and goat producers in order to retain a critical mass of sheep and goat production in the EU. The EC and the EU Council of Agriculture Ministers is asked to restructure the future financing of these sectors as part of the CAP Health Check through the implementation of a variety of measures, giving each Member State the flexibility of choosing from the following possible financing options:

- Introduction of a new Environmental Sheep Maintenance Scheme per ewe to be either a) financed directly by National Government funding, or b) co-financed by EU and National Governments to arrest the decline in production, linked to the positive environmental attributes associated with the maintenance of sheep production as well as achieving improvements in technical and quality areas of production;

- Analysis of the availability and utilisation of unused funds under Pillar 2 of the CAP with a view to redirecting this support to the sheep and goat sectors;

- Amend Article 69 of EU Regulation 1782/2003 as proposed by the EC CAP Health Check Communication, to provide flexibility for Member States;

- Use modulation support as referenced under EU Regulation 1782/2003 to sheep and goat producers;

4. Calls on the EC to introduce an additional payment for traditional mountainous breeds in order to preserve sheep in sensitive areas, to be either a) financed directly by National Governments or b) co-financed by EU and National Governments.

5. As part of the simplification process in the review of the CAP Health Check, request that the EC allow 14 days notice to livestock farmers for on-farm cross-compliance inspections.

6. Notes that the return to the producer for sheepmeat products as a percentage of the retail price is insufficient.

7. Calls on the EC and the EU Council of Agriculture Ministers to review the introduction of an electronic identification system for sheep intended for 31/12/2009 due to the difficulty in implementation, high costs and unproven benefits; and asks that each Member State be allowed the discretion of introducing this system on a voluntary basis;.

8. Calls on the negotiating team for the EU at the WTO talks to reduce the scale of the proposed tariff cuts on sheepmeat and to ensure that the option of sensitive product status for certain sheepmeat lines be available to the EU.

9. Calls on the EC to review existing import quota management regimes to ensure that domestically produced lamb is not exposed to unfair competition

10. Calls on the EC to introduce a mandatory EU labelling regulation system for sheepmeat products, which would have an EU wide logo to allow consumers to distinguish between EU products and those from third countries. It is suggested that this would be underwritten by a number of criteria including a farm assurance scheme and a country of origin indication, ensuring that consumers are fully aware as to the point of origin of the product.

11. Calls on the EC to increase the current annual EU Food Promotion Budget (valued at €45 million for 2008), and to ring fence funding for EU lamb and to change, simplify and streamline the practical rules governing the operation of the budget so that lamb products can be given meaningful access to the budget.

12. Calls on the EC to co-ordinate promotional campaigns for PGI (Protected Geographical Indication) and PDO (Protected Designation of Origin) sheepmeat and goatmeat products, and to target relevant EU countries in order to maximise consumption.

13. Calls on the EC to provide assistance in opening export markets for EU sheepmeat and offals in countries where unnecessary restrictions currently apply.

14. Calls on the EC to include lamb in the 'Community action programme for public health' in order to promote the health and protein benefits of lamb to consumers, particularly to young people who are low consumers of lamb products.

15. Calls on the EC to support innovation in the 'small ruminant' industry, concentrating on both technical innovation for farms and product innovation with regard to lamb, cheese and by-products such as wool and pelts, known as the fifth quarter, where the financial return is almost negligible at present.

16. Stresses the need to improve the availability of medicinal and veterinary products for the sheep and goat sectors at a European level through the simplification of marketing authorisations

17. Calls on the EC to publish a price series on retail, wholesale, processor and producer prices for each Member State on the Internet every three months to ensure more price transparency within the European sheep sector.

18. Request the EC and the Presidency of the Council to set up an implementation task force to oversee the practical reform of the sheep and goat sectors in the EU, and to ensure that this implementation task force reports to the European Parliament Agriculture Committee and the EU Council of Agriculture Ministers every six months for the next two years on the policy

changes that it is enacting. Also that this implementation task force should be comprised of key officials from the EC and from the countries representing the four forthcoming Presidencies of the EU.

Explanatory statement

Introduction

The sheep and goat sectors in Europe are at a critical stage. Urgent measures need to be taken at EU level to preserve sheep and goat farming on an economically sustainable basis. The structural decline in the production of sheep and goats has significantly accelerated since the 2003 CAP reform. Sheep and goat farming is a labour intensive activity that requires specific skills. Unfortunately, there is a lack of technical services and training in the sectors. Incomes are low compared to other farm enterprises and depend to a large extent on public support.

These sectors are experiencing increasing costs, particularly as regards fuel, electricity and feed, which will be further increased with the proposed introduction of electronic identification in 2010. The age profile of sheep and goat farmers is much older than in other agricultural sectors and it is increasingly difficult to attract young farmers to the business. There is high competition for land, particularly in the context of high prices for cereals. Processing enterprises are especially challenged, with difficulties as regards investment and the lack of a qualified workforce. The competitive pressure from third country imports has increased.

It is estimated that a lack of action will result in a decrease in the production of sheepmeat and goatmeat of at least 8 to 10% by the year 2015. Against the backdrop of rising food prices, such a decline cannot be allowed to occur as it is essential to maintain a security of supply within the EU. The imminent 'Health Check' of the CAP provides a timely opportunity to review the sheep and goat sectors and implement proposals before it is too late.

Main issues raised by Rapporteur

Environment

Sheep and goat farming play a key environmental role that includes the natural upkeep of less fertile areas, the maintenance of biodiversity, sensitive ecosystems and water quality, the fight against erosion, floods, avalanches and fires. Typically, sheep and goat farming take place in less favoured areas, where such farming is often the only agricultural option and which therefore makes a crucial contribution to the economy in rural areas within the EU.

Producer income support

Farm incomes in the sheep and goat sectors are amongst the lowest in the agricultural industry and the financial support received falls well behind that of other more profitable agricultural sectors.

The Common Agricultural Policy has failed the sheep and goat sectors and this has led to a substantial fall in production. The 'decoupling' package introduced in the CAP Reform 2003 has contributed to this decline in production. The forthcoming CAP Health Check must direct additional financial support to sheepmeat and goatmeat production taking into account the different models that exist in Member States. It must be noted that a 'no-one-fits-all' solution in terms of the future financing of the sheep and goat sectors can apply in an equal way in each Member State in the EU.

Electronic tagging

The European Commission intends to introduce compulsory implementation of an electronic identification system for sheep on 31/12/2009. This is a huge issue for the entire sheep sector. At a time when the sector is in an economic crisis, this proposal will burden producers with additional costs. Furthermore, the benefits of electronic tagging have yet to be proven.

It is suggested therefore allowing each Member State the flexibility of introducing the identification system on a voluntary basis, given the fact that in most countries in the EU there are already adequate identification systems in place to deliver the requirements for traceability and animal health.

Sheepmeat imports

Imports in excess of 20% of EU lamb consumption have a significant bearing within the EU market place. It is acknowledged that third country lamb imports play an adjusting role, given the current EU deficit. However, given that lamb imports will continue to contribute a major part of overall EU supply, efforts must be made to ensure that lamb imports supplement the EU supply without inhibiting the ability of the EU supply to develop. It is clear that the higher costs of production carried by EU lamb put the domestic product at a competitive disadvantage compared to the imported product. This imbalance is all the more obvious given that imports are concentrated mainly in two sensitive periods in the European calendar i.e. Easter and Christmas.

Decrease in the consumption of sheepmeat

Consumption has dropped as a result of lower availability and the relatively high price of sheepmeat. Consumers of sheepmeat essentially belong to higher age groups, with above-average income. In contrast, the penetration rate of the product and the number of consumers below 35 years of age are considerably smaller. Factors such as consumer age profile, consumer perception and price relative to other proteins significantly affect potential levels of lamb consumption. The key to securing a sustainable future for the sheepmeat sector will be strategies aimed at recovering consumption levels across the Community.

Marketing of lamb

In order to generate lamb consumption, a number of measures need to be adopted. It is recognised that there is a need for innovation in the communication of the message to consumers. Younger customers, who are low consumers of lamb, need to be targeted emphasizing the convenience, quality and health aspects of the product, with the core objective of increasing consumption but also adding value to EU lamb. The French, Irish and British food promotion agencies are currently conducting a joint generic promotional campaign to increase lamb consumption in France. This may lay the basis for future marketing campaigns in other EU Member States.

Domestically produced lamb must have access to the EU fund for the promotion of agricultural products, which is valued at €45 million for the year 2008, but in the majority of EU countries, the sheep and goat sectors are not utilising European Promotion programmes under EU Regulation 1257/1999 (superior quality products labelled at a national level) and EU Regulation 1171/2005 (products bearing European official quality marks). The reason for this is that the rules governing these regulations are too restrictive and must have a national quality label or a European quality mark, such as PDO (Protected Designation of Origin), PGI (Protected Geographical Indication) and TSG (Traditional Speciality Guaranteed).

The European Commission is asked to simplify these regulations giving the sheep and goat sectors real access to this budget. The existing EU fund for the promotion of agricultural products needs to be increased and a proportion of this fund allocated to the sheepmeat sector. It is also suggested that PGI/PDO campaigns be co-ordinated for sheep and goat products, to target certain EU countries so as to increase consumption.

Labelling

At present there is no EU legislation dealing with the issue of origin labelling for the sheepmeat sector. As a result there are many different labelling techniques in operation within the EU for sheep products. In order to promote EU preference amongst consumers and also to justify supporting the promotion/marketing of sheepmeat, consumers would need to be convinced on the basis of food security, indigenous EU production and traditional methods of production.

It is suggested that consumers should be given maximum information about the origin of the product, which they purchase so that they can make informed purchases. In this regard it is proposed that a EU logo be developed for sheepmeat products, which would be underwritten by a number of criteria including a farm assurance scheme and a country of origin indication, thus ensuring that consumers are fully aware as to the point of origin of the product.

Support for innovation

Innovation in product development has the potential to be the key to making sheepmeat more attractive to younger generations of consumers. Such innovation should focus on the imbalance between the cuts currently demanded by the consumer and the cuts arising from the whole carcass. There has to date been some success in attracting the younger consumers through offering a versatile range of cuts, a wider range of portion sizes, packaging and a consistent quality product, indicating that lamb should not be abandoned as a lost cause as far as the market is concerned but rather could flourish with support in developing innovation on products, packaging and processes.

At present, the amount of financial return on wool and pelts (the so called fifth quarter) is insignificant. Developing new uses such as highly efficient and ecological thermal insulating material could increase value.

Market access

At the moment, there are restrictions governing EU exports of sheepmeat products into countries such as South Africa, Algeria, Saudi Arabia, China, and Mexico. It would be of positive significance to the industry if the European Commission were to provide assistance in opening non EU export markets for sheepmeat products in countries where unnecessary restrictions apply.

Consultation

Ernst and Young Government Services together with the French Livestock Institute, carried out a study entitled 'The future of the sheepmeat and goatmeat sectors in Europe', which was commissioned by The European Parliament. The study analysed the characteristics of these sectors and made a series of recommendations, which were presented to a meeting of the European Parliament Agriculture Committee on February 26, 2008.

In the preparation of this report widespread consultation was carried out, including meetings with the EU Commissioner for Agriculture and Rural Development, the Slovenian Minister for Agriculture, the French Minister for Agriculture together with Agriculture Ministers from Poland, Lithuania, Ireland and Council representatives from the UK, Spain, Italy, France, Latvia, Romania, Bulgaria and Germany. Also included were EU farming groups, EU business groups, EU consumer groups, and representatives from the EU lamb processing sector as well as representatives of the sheepmeat sector in Australia and New Zealand. Relevant officials from the Directorates of the European Commission (who deal with Agriculture and Rural Development and Public Health matters) were also consulted. In addition, prior to publication a lamb promotion evening was hosted in the European Parliament on December 4, 2007 sponsored by Eblex (English Beef and Lamb Executive), Bord Bia (Irish Food Agency) and Interbev (French Livestock Association). This brought together 200 representatives from EU farming groups, EU lamb processors, consumer representatives from the 27 EU Member States, the EU Agriculture Commissioner, the President of the European Parliament, the Chairman of the

Agriculture Committee of the European Parliament, MEPs and representatives from Agriculture policy units of the European Commission and from the European Permanent Representations.

Conclusion

The long-term sustainability of sheep and goat production in the EU on a professional scale is under severe threat. Despite a production deficit of sheepmeat in the EU, the sheep flock continues to fall and demand for shepmeat is weak. The last CAP Reform (2003) introduced the decoupling of direct payments, and accelerated the contraction of the sheep and goat sectors. Sheep and goats are located primarily in less favoured areas and play a critical environmental role in the natural upkeep of these areas as well as making a huge socio-economic contribution to disadvantage areas.

Many producers are exiting the sheep and goat sectors due to economic difficulties, high labour requirements and an older age profile. There are increased pressures from third country imports. This is on top of unnecessary restrictions that apply to EU sheepmeat exports into certain third countries.

Urgent action is needed at EU level to safeguard the sheep and goat sectors, including producer income support, electronic identification to be brought in on a voluntary basis, marketing measures to generate consumption, a labelling scheme to give EU consumers maximum information about the origin of their purchases and support for innovation. It is essential that an EU implementation task force is set up to ensure that the specific measures recommended in this report are enacted over the next two years, thereby securing the future of the sheep and goat sectors in Europe.

TechnoGrazing™ – a novel approach to sustainable pastoral production

J.F.L. (Deric) Charlton
23 Sycamore Cresent, Palmerston North, New Zealand
Email: dericpat@gmail.com

J.H. (Harry) Wier
Kiwitech International Ltd, PO Box 19, Bulls, New Zealand
Email: kiwitech@kiwitech.co.nz

Keywords: TechnoGrazing; controlled grazing; bull beef; electric fencing; temporary fencing; irrigation; water supply; sustainability.

Summary

TechnoGrazing (TG) is an intensive yet sustainable grazing system developed by organic beef farmer Harry Wier in the lower North Island of New Zealand. Wier adapted the pasture/animal research findings of Brougham and others into a practical and profitable farm management system, initially for farming entire bulls but later for sheep, deer and dairy cattle. He also developed cost-effective fencing and livestock watering materials (and related accessories), and now trains farmers to use the concept and his equipment successfully on pastoral farms, mainly in Australia, New Zealand and South America.

The system achieves high yielding efficient livestock production with minimum investment in plant, equipment and labour. The system has also proved sustainable over many years and has many features that are environmentally positive.

The paper outlines the concept, examines what makes TG so productive and sustainable, and gives some general case studies from Australasian farms that illustrate the potential in Ireland.

The TechnoGrazing system

TechnoGrazing evolved from the debate about rotational grazing vs. set-stocking. Authors like Voisin (1959) and Martin Jones (1933) in Europe, and C.P. McMeekan in New Zealand, made this a fascinating quest to find the best system. During study at Massey University, Wier's convictions about rotational grazing were cemented by a visit to a trial run by Ray Brougham (late director of DSIR's Grasslands Division, Palmerston North) who was studying various pasture management phenomena using young dairy-bred bulls as the animal component. The most significant outcome was not the actual comparative trial results themselves, but the fact that he achieved a production level of about 1100 kg/ha of net carcase gain with low inputs, a high stocking rate and small group sizes.

At that time bull beef production was a recent innovation in commercial farming, driven by the demand for very lean meat to supplement fat-trim from the US beef feedlot industry for hamburger production. As part of his university studies, Wier visited several pioneer bull beef producers and realised that the high price for bull meat, the low cost of calves and the inherent efficiency of lean meat production made "bull beef" an interesting commercial prospect. Wier's father had died several years earlier, so Wier went straight from university to running his own farm with no one but himself to answer to. He immediately started ripping out the entire farm infrastructure, including all fences and watering systems, the sheep shearing and handling facilities; he even relocated most of the farm roads! His aim was to achieve the production levels of Brougham's trial, but on a commercial farm scale.

Novel development

In planning his new system, Wier was convinced of two key factors: 1) the need for many subdivisions meant that the only practical approach was to make major use of temporary electric fencing; and 2) the need for a novel watering system to provide a multitude of watering points at an affordable cost. He soon worked out that long narrow permanent 'lanes' would make temporary fencing much easier, and that calibrating small grazing cells using the fence posts as markers would be very handy. Initially, Wier used off-the-shelf fencing hardware and various crude improvisations for his portable water troughs and hydrants.

Early experiences with bulls at 50 per group convinced him he had to try smaller mobs. He also found managing a gun irrigator on a 14-day cycle very difficult when bulls were on a 30-40 day rotation. He discovered he could safely handle electric fences by wearing appropriate footwear and would cross the fences on a motorbike and handle the bulls by using 'hot wiring' as a herding and drafting tool. He found that he could reduce mob size to 20 and save much work by running bull mobs side-by-side in a set of six permanent lanes with continuous temporary wires (front and back fences) laid on top of the permanent fences. He invented a 'fence fender' apparatus for the irrigator to travel under temporary fences, so that it could run through a mob of bulls, eliminating the logistical problem of dodging bull groups that were on a different rotation cycle.

At the same time, Wier continuously upgraded and developed the fencing and watering hardware components. Advances included the use of fibreglass fenceposts, lighter gauge high-tensile wire and springs to create a lightweight, highly resilient fence that was tough enough to handle bulls yet flexible enough to pin down for stock movement and vehicle crossing.

In 1982 Wier and his wife Chloe established a business manufacturing and marketing their fencing hardware under the brand of *Spider Fencing* that reflected the spider-web character of the permanent fence. In 1992 Wier decided that the most valuable innovation he could offer his clients was the grazing concept itself. The concept had become a tightly integrated package of technologies and know-how including fencing layout and grazing configurations, design methodologies, practical field techniques, and fencing, watering and animal handling hardware. The term '*technosystem*' was quickly applied to the Wier grazing system exclusively.

In the following decade Wier kept developing the tools and sold the TG concept to Australasian customers as a design, training and hardware package. He also converted the farm to certified organic production, partly because he believed in biological rather than chemical solutions, but also to demonstrate that his grazing system was more than just a 'bull beef system' and applicable to all grazing livestock classes and that it was valuable for sustainability as well as productivity.

TechnoGrazing layout

The basic TG layout is one of long narrow pasture lanes bounded by permanent *Spider* fences with fibreglass 'node' posts positioned at intervals along each permanent fence line to define identically-sized areas (the area bounded by 4 nodes). The CAD-based design always ensures that the node posts lie on a straight line across a set of lanes (even when the lanes are not straight or parallel, so the farmer shifting livestock can see clearly where to lay out the next fence). There are many different shifting options with TG, as animals can be moved under or over the temporary and permanent fences. Where groups proceed in unison along adjacent lanes this is called '*multiplex*' grazing. However groups are often allocated two or more lanes and '*hopscotch*' from one end of the system to the other. Yet another mode is the '*racetrack*' where groups go along one lane and return in the lane next-door. Systems can even be circular to suit centre-pivot irrigators. GPS technology is used in conjunction with CAD design to initially survey the site and later to set out node posts to within 2 cm.

There are no traditional gates within TG as the fencing is resilient enough to allow modified farm vehicles to be driven over (or under) wires. To move the temporary fence the farmer simply drives over the permanent fences, reeling in the wire and collecting the temporary posts, and then lays out the new cross-fence by reversing this procedure. Typically, the farmer uses an all-terrain vehicle (ATV or 'quad' motorbike) equipped with fence fenders and a '*PowerPac'* reel to handle the temporary fences. The *PowerPac* winds in the temporary wire at high speed as the farmer drives along the temporary fence line, and it flicks the wire out of the 'tread-in' posts and rips the post out of the ground for the operator to collect and stow. If the ground is flat and the lanes are less than 40 m wide, no tread-in posts are used, enabling a complete set of 6-8 lanes (mobs) to be moved in under ten minutes.

Water supply

A new watering system was also developed and manufactured, based on portable 100 litre troughs with special bayonet-style water couplings, as well as permanent '*Micro-troughs*'. The *Micro-troughs* are the size and shape of a medium-sized kitchen-mixing bowl, and are made from heavy-walled low-density polyethylene. A plate activates the trough valve when an animal pushes it down. The troughs are connected by poly-pipes and are situated along alternating permanent fences, giving stock access from either grazing lane.

Micrograzing – why TechnoGrazing works

Microeconomics focuses on individual businesses and consumers and takes a bottom-up approach to analysing the economy, whereas macroeconomics looks at entire countries and takes a top-down approach. Applying the same approach to grazing management, - focusing on the individual partition or grazing cell and studying variables and production functions at that level to determine farm outcomes can be described as '*micro-grazing*'. The other option, '*macro-grazing*', takes the whole-farm perspective and focuses on feed budgets and models based on broad-brush parameters, such as average pasture growth rates, average farm stocking rate, average residuals, and average quality adjusted by season. Macro-grazing is the industry-standard model at this stage, but TG produces results that defy the standard model predictions. Consultants find that their computer models have to be re-calibrated for TG to produce predictions from their models that match actual farm outcomes.

Clearly there are parameters within the TG model that are changing fundamental biological/physical relationships (what an economist would call "production functions") and it is hard to see how these changes will be unravelled by studying the system from the top down (macro-grazing). Taking the micro-grazing approach to determine the critical parameters and their interrelationships is the only practical option. The most obvious parameters that differ between traditional grazing and TG is that pasture subdivisions are about two orders of magnitude smaller with TG (hundredths of hectares rather than hectares), the mob sizes are much smaller (20 or so per cattle group), and the grazing on-time is shorter (1-2 days).

Micrograzing as a research area does not really exist, probably because good tools for grazing at the intensity of TG are not available. Notwithstanding a lack of hard data, logic, commonsense, visual appraisal and farmer experience, all provide many clues as to why these productivity differences are achieved, and reveal the many obvious benefits of a tool that gives us a very fine level of subdivision in a system that is logistically very efficient.

These include:

Fertility Transfer

When a large group of animals spends a lot of time around centralised watering points, under shade trees or on favoured 'stock camps' there is very significant transfer of fertility to these sites at the expense of the main grazing area, and this nutrient concentration also accelerates leaching. Small groups, small grazing areas and a proliferation of watering points obviously mitigate this fertility transfer.

Managing the seasonal forage production curve

The most challenging aspect of grazing management is to maximise production in the face of large, semi-predictable variations in pasture growth rate. The single biggest constraint to maximising total output per hectare on most grazing farms is the inability to convert enough spring pasture into animal product. Either, the stocking rate is too low, so utilisation rates and pasture quality suffer dramatically, or too much high-quality spring forage is expensively and wastefully converted into lower-quality conserved forage. Traditional techniques for coping with erratic pasture growth (forage conservation, fertiliser nitrogen, forage cropping, and purchased supplements) tend to involve high costs, wastage, pasture and soil damage, fossil fuels, man-hours, chemicals, and costly plant and machinery.

TG and its associated technologies and techniques allow the farmer to control animal intake precisely without sacrificing average pasture cover (long rotations leave most of the grazing area with good covers, even though recently grazed areas are very short when intake is restricted). This capability to control intake *and* cover means that it is possible to improve utilisation efficiency during periods of low pasture production, pick up some gains in terms of pasture quality and animal compensatory growth potential, ration out forage that has been stockpiled in advance, and maximise the pasture growth rate – all at the same time. There are no additional costs – no use of fossil fuel, chemicals, machinery, or extra work, and the effect on the pasture is usually very positive. Note that a 'wintering mode' is not nearly as practical with large paddocks, large groups and long grazing on-times – utilisation efficiency will decline, soil damage increase, regrowth will be compromised and the animals will suffer from dramatic swings in intake.

The most profound benefit of this grazing management capability is that the farmer can carry enough stock through the winter at very low cost, to fully utilise spring production which, of course, converts so well into animal production. Furthermore there are similar benefits throughout the year where the farmer can soften the peaks and troughs of grass production by adjusting rotation length in a very precise, easily managed way.

The same precision capability can be used to adjust grazing intensity to control weeds in selected areas, to selectively allocate grass to special stock classes, to avoid wet areas at certain times, and to encourage/discourage selected pasture species.

Pugging Management

Most farmers would feel that intensive grazing means more soil and pasture damage in wet conditions. Many comment that 'intensive grazing is a good idea but my soil is too wet'. From the micrograzing perspective, these popular perceptions are not accurate.

Firstly, moderate soil impact is often good. For example, highly productive grasses like perennial ryegrass are much more tolerant of rigorous pugging than most unproductive grasses and broadleaf weeds, especially when seedlings. So, any treading that pastures receive under intensive grazing works to improve pasture composition through a weeding effect. Secondly, hoof impact, especially moderately severe hoof impact, can be a very effective way to keep pasture-damaging insect pests and their larval stages under control.

In New Zealand, several serious pasture pests can be checked by 'mob-stocking' (using very high stocking densities with a short on-time). If this mob-stocking occurs when the soil is holding significant moisture it can be even more effective, especially on lighter soils. This is seen with TG in the pasture strip underneath a permanent electric fence (zero treading) – it is often poor in composition, yellowish and harbours high populations of pests and larvae. In South America, much grassland is covered with anthills but these disappear under intensive grazing.

Despite such positive treading effects, there is no doubt that widespread heavy pugging is harmful to pastures, especially 'young' pastures with under-developed soil structure and soil biology. However, the perception that intensive grazing using high stocking rates through winter on heavy soils will inevitably produce severe pugging damage and long-term productivity loss is incorrect.

The management variables that really matter with regard to pugging damage are:

- Immediate stocking density (kg liveweight/ha) on the currently grazed subdivision.
- Level of animal activity (hoofsteps/head/day).
- Grazing on-time (days, or part-days).
- Recovery time (days) before subsequent grazing – this greatly influences the number of 'wet grazings' likely to occur per year for a given area.

TG offers some major benefits that more than offset the fact that it does tend to run a high stocking density:

- Cattle run in small, socially stable groups under very routine management, grazing fresh forage at least every two days, on a restricted diet (in winter) are much less boisterous and take a far fewer footsteps per day than animals in a conventional system.

- The small size of subdivisions minimises the footsteps taken per day by livestock, as there is little distance to water and forage. However this is very sensitive to the absolute subdivision size and shape. Small, but not slender areas tend to reduce group surging behaviour seen when rain squalls alternate with clearer weather. As well as reducing the risk of pugging/treading, a reduction in animal activity conserves energy that can be diverted to weight gain.
- Because the winter rotation is long (70-120 days in New Zealand) and grazing on-time is short (daily shifting preferable on wet areas), the pasture has a long period of uninterrupted regrowth to recover from any treading. There is much less chance that a given area will suffer a second or third wet grazing – very important because once a soil has been smeared it is more prone to water-logging and treading damage. The short grazing on-on-time helps because, after a certain degree of animal treading the soil damage changes from moderate to serious, which makes recovery much slower. A shorter grazing time might seem to imply a higher stocking density which could be self-defeating, but the typical behaviour in rainy conditions is for the group to huddle in one corner of a grazing area, and that area will be exposed to similar damage whether the overall area is small or large.

In summary – treading impact is a very important micro-grazing parameter, given the right management it offers more benefits than drawbacks.

Annual pasture yield

Early proponents, particularly French farmer Andre Voisin (1959), tended to exaggerate the improvement in the digestible organic matter yield that intelligent rotational grazing generated. In fact, isolating the yield parameter is quite difficult because of its interaction with utilisation; long-term average tiller density, long-term pasture composition and fertility transfer effects (especially nitrogen). Some trends concerning yield and grazing management can be stated with reasonable confidence:

- More erect cultivars/species tend to out-produce prostrate forms, but need longer recovery periods (normally a TG feature) to express their potential and ensure their longevity.
- Yields are very sensitive to the maintenance of a good photosynthetic canopy in a pasture. In winter/early spring however, a pasture typically suffers from an inadequate leaf area index, whereas summer to early winter growth is often compromised by seedy senescent material standing above the main canopy. Managing the canopy to avoid these ills can be achieved purely by grazing management. TG is primarily aimed at providing the tools for managing pasture canopy.

Pasture Utilisation

Most farmers are aware that harvesting a larger fraction of the total annual DM yield (reducing wastage from spoilage and senescence) is an important way of increasing total animal production per hectare. They also know that they can improve utilisation rates with higher stocking rates and more subdivision. Commonsense suggests that if a farmer has a hungry animal and offers it only as much forage as it can eat in, say four hours, that a much smaller fraction of that forage will be soiled and trampled than if the hungry animal was offered a week's worth of the same ration at one time, especially if the standing mass is large. However, farmers are much less conscious of the influence of utilisation rates on pasture composition, tiller density, quality and longevity, and very few appreciate the central role played in grazing management by the conflict between pasture utilisation ratios and animal feed conversion ratios.

Higher stocking pressures (appetite versus offer) give higher utilisation rates, less selective grazing and lower residuals, which translate into improved quality on subsequent grazings (more fresh growth and less weed content), higher tiller densities (because of better light penetration), shorter residuals and less 'squodging' (squashing and lodging of older grass onto developing tillers). All this leads to improve pasture longevity – a vastly under-rated contributor to long-term productivity.

Pasture composition can improve with time, especially with regard to plants adapting to local eco-niches. Below ground there are also marked improvements in soil structure, organic matter content and soil biology. Older pastures can be very productive, but more importantly, they are much more resilient to adverse conditions such as treading, drought, flooding, pests and diseases than juvenile pastures. Of course, pasture renewal is not cheap and some production is inevitably lost during its establishment.

While there is a fairly poor appreciation of the pasture benefits of heavy stocking pressure, there is widespread awareness of the need to feed animals generously for improved productivity. Intuitively, farmers know that bigger rates of gain are associated with better feed conversion ratios; counter-intuitively, this association is non-linear and a 50% increase in liveweight gain from 1 kg/day to 1.5 kg/day might improve feed conversion ratios by only 10%.

A 10% improvement in pasture utilisation and/or quality is probably much easier to achieve than a 50% improvement in weight gain, and since rate of gain is so sensitive to pasture quality, chasing gains at the expense of utilisation is often self-defeating. High stocking pressures, *under good management*, can do many desirable things to the pasture and improve utilisation, but this comes at the short-term cost of lowering animal intakes and hence feed conversion.

The textbook description of the interaction between production vs. stocking rate shows a dome-shaped graph with maximum production at the top of the dome. However, under TG that dome is probably flatter, with the maximum occuring at a higher point on both axes. It is flatter because a farmer can maintain average pasture covers even while restricting intake, whereas the traditional model soon falls apart when additional stocking pressure runs down the pasture canopy at critical times such as late-winter/early-spring. It is also higher because of the efficiencies discussed, such as a much higher utilisation ratio. Deciding on the optimum stocking rate for a farm is a difficult business because of climatic and market uncertainty, but it is easier for TG farms, because of the flatter graph referred to above. The flatter graph implies less sensitivity to seasonal variation and less risk of very poor performance in years of low pasture production.

Animal Stress

Small, socially stable groups under a regular routine are visibly less stressed than their counterparts (large gps. Moved less frequently). This is obvious with bulls that show stress in no uncertain terms, but other stock classes are probably just as affected, even if the signs are subtler. A good gauge of stress levels is the length of time livestock spend lying down and grooming – elevated social activity and its influence on treading have already been discussed. Most farmers are aware that contented animals finish well and many human studies show that stress predisposes to disease and interferes with normal growth and development. Since bull's stress symptoms are so obviously reduced, it is reasonable to accept that TG is a good model in this respect. A study in New Zealand, found that TG bulls were quieter and fought less than those under conventional management (M.W. Fisher, *pers. comm.*). So it is safe to assume that lower stress under TG is another micro-grazing variable that contributes to overall performance.

Animal Health

Less stress indicates better immune response and lower susceptibility to a variety of diseases, but there are strong indications that TG directly mitigates at least some animal diseases more directly:

- Facial Eczema is a liver disease prevalent in New Zealand caused by the fungal spores of *Pythomices chartarum*. The fungus thrives in dead pasture litter and can cause serious long term symptoms and death, especially in sheep, but also in cattle. The fungus is most active during autumn in warm humid conditions. Stock under TG do not appear to be susceptible to this disease, probably because of the lower thatch and litter levels evident under TG.

Internal parasites are probably the most economically significant animal health problem of ruminants world-wide, and drench resistance in parasites looms as a very serious problem.

TG provides an excellent platform to practice alternative parasite management:

- Alternating grazings with different stock class (sheep with cattle, or calves with older cattle) greatly assists in minimising the larval challenge in a pasture.
- Including condensed tannin-containing legumes (such as *Lotus* species) and herbs that are known to lower parasitism (chicory and plantain) in a pasture also helps significantly. These legumes and grazing herbs flourish under TG and are more persistent compared with conventionally grazed herbal pastures.

• Soil is much more biologically active under old TG pasture, and when combined with high digestibility forage, means that the 'half life' of dung pats is so short that that they have usually gone before the next grazing, so larva survival is likely to decline markedly. The lack of thatch and litter in a typical TG sward also exposes parasitic larvae to desiccation and sunlight.

• For some parasite species (in particular *Haemoncus*) long winter rotations are particularly effective in reducing worm burdens. A four-year trial near Armidale in Australia by Dr Lewis Kahn, University of New England and farmer Rob Kelly has shown that under TG, egg counts are between 20% and 0.1% of the levels found in conventionally - grazed lambs, despite a stocking rate that is over 50% higher than the latter. The same trial has shown improvements in ground cover, water infiltration rates and weed-free status under TG.

Successful adaption on farms

TechnoGrazing™ has been in commercial use by the developer for more than 30 years, and by commercial farmers for the past 20 years. It has been demonstrated to be a reliable and profitable concept when used properly and in suitable situations. To date no environmental deterioration has been recorded from TG farms, indicating that it is a sustainable farming system. The following summaries are a few examples of the successful adoption of the TG system:

<u>Australia</u>

Tom Ellis runs Coola Station near Mount Gambier in southwest South Australia, where average rainfall is 675 mm, falling mostly between April and December. Summer temperatures can reach 40°C. The property comprises a total of 2,464 ha, with 1,193 ha in intensive grazing, and is managed with three full-time staff. The remainder of Coola Station is run in traditional sheep breeding and steer finishing. At present 681 ha is in classic multi-lane TG, and 125 ha has centre-pivot irrigation and is a circular grazing system, resembling an unusual dartboard. A further 387 ha is in a larger block-grazing system using TG lanes with three wires to run Coopworth sheep.

The average stocking rate on TG at Coola is 3 bulls/ha, with up to 3500 bulls (averaging 700 kg/lwtg/ha) carried on a seasonal basis. The grazing systems are stocked from April to June with bulls weighing 250 – 400 kg at a time when pasture growth is optimal. De-stocking begins in spring (October) and is usually completed by early summer (January) before pastures dry off. Most bulls are sent to slaughter with some smaller bulls going to supply a feedlot.

The farm sits on sheet limestone, with soils ranging from sandy loam to heavy black with large deposits of flint rock through most of the farm. When TG was first started, the pastures were based on native annual species with some older cocksfoot. In more recent times older pastures have been replaced, initially with cocksfoot, but latterly with newer cocksfoot and tall fescue selections (in this region perennial ryegrass performance suffers from summer droughts).

Approximately 100 ha are sown to lucerne. Soil fertility is moderately high. Superphosphate and some urea is applied annually to the grazing land. Compost poultry manure is also applied at 1000 kg/ha.

Near Guyra on the New South Wales tablelands, Rob Kelly jointly runs Superfine Merino sheep on a 570 ha property with his siblings. Using TG they have more than doubled gross margins. The farm has typical low-moderately fertile granite soils and natural pastures. Annual rainfall averages 850-900 mm, but can vary immensely. Historically, the family ran sheep mostly by set stocking at six ewes/ha, almost continuously grazing the same land. Recently however the stocking rate on the farm has increased to 10 ewes/ha with gross margins of $335/ha – a two-thirds increase. This was achieved in conjunction with a trial carried out by Dr Lewis Kahn (University of New England), who compared the traditional management (5-6 ewes/ha) with two TG areas on 75 ha stocked at 6.8 and 9.7 ewes/ha respectively.

Monitoring showed that the traditional management returned A$29.65/ewe in two years, giving a gross margin of A$148.26/ha. This contrasted with TG ewes at 6.8/ha, which returned A$30.81/ewe or A$209.48/ha. At 9.7 ewes/ha under TG, returns were boosted to A$34.60/ewe or A$335.64/ha. Despite carrying more animals the TG ensured a good quality feed supply. The trial began in May 2003 and by autumn 2004 the TG areas had 3,500 - 4,000 kg DM/ha of forage, a threefold increase compared with 1,000 kg DM/ha for the set-stocked system.

Factors favouring TG in this situation are thought to include more milk from ewes during early lactation, a closer proximity of ewes and lambs in the small grazing cells, and lower worm levels in lambs. The lambs under TG initially had tenfold fewer internal parasites than those on set-stocked pasture, though this declined to five fold when the rotations were slowed trying to boost lamb weights. Currently the system applies spells of 50-70 days rather than 30-40 days. The target is 15.6 DSE/ha and at 10 ewes/ha this is achieved. Experience suggests that it is best to put TG on the most productive land, and to use it as the driving force behind the enterprise. A farmer can run enough livestock on the TG area to ease pressure on the remaining farm area, offering a chance to develop it further.

<u>New Zealand</u>

John Hudson who farms 1120 ha at Gwavas Station near Tikikino in dryland Hawke's Bay was the first farmer to attend Wier's TG course and install the concept. He runs bulls under TG on part of the farm at 4.14/ha, with returns exceeding NZ$2,000/ha (Taylor, 2001). Bulls start into the system at 402 kg in August and are sold by December before onset of summer drought.

Gwavas Station was used for a Sustainable Land Management project (Rhodes 1999), and TG was approved as a sustainable land management system following several years of assessment. Consultants involved used standard decision-support software and warned Hudson that according to their output TG wouldn't work, but the system proved them wrong and adjustments then had to be made when assessing TG. Hudson reported that his gross margin returns rose significantly when he changed from conventional beef grazing to TG.

Angus Mabin farms near Waipukurau in dryland Hawke's Bay in eastern North Island, farming nearly 3000 bulls on close to 1100 ha (including 167 ha of rolling hills and 100 ha leased). Mabin developed his first TG in 1997 and is now running dairy bulls on all except 77 ha for deer. Previously the farm was subdivided into blocks of 6-10 ha that were set-stocked by beef cattle at 10-25 per mob (0.6-0.75/acre). However feed shortages occurred every winter and the system required high labour input. Weed invasion was also problem in the less productive browntop-dominant pastures. The system now runs rising two-year-old bulls under TG, buying them in autumn at 350-450 kg. They are finished at 600-650 kg and sold by late January before summer drought sets in.

The past few years have seen long summer droughts. To date there has been no regrassing as the existing pastures improved markedly under TG, and have remained resilient. Following the severed droughts, some pasture areas have been lost on the free-draining land, though it will recover on the heavier soils.

Mabin considers TG to be "very powerful and flexible, particularly in drought seasons" and even during drought can deliver some high quality regrowth, enabling him to continue grazing. Once the rains return in autumn he can restock quickly and his farm production remains well ahead of neighbouring properties using conventional management. Stock are checked when moving them every two days, and disease prevention is much better than with the previous conventional system.

Ron and Chrissy McCloy milk a herd of 46 cows on a 20ha TG system, rear over 500 bobby calves on the milk and then finish the weaners on TG in Northland (north of Auckland), capturing the calf rearing and weaning margins that other bull-beef finishers must pay to purchase stock. Their very supportive bank manager was initially doubtful about TG but now sends others to see the McCloys, as the production and revenue levels have impressed him so much. The McCloys purchased the 250ha farm in 2004 and established a milking herd, calf rearing and beef finishing system. They put in 120ha of TG and purchased an adjoining 80ha in 2006 and 100ha recently. They are aiming for 1000kg/ha liveweight (LW) gain using TG over the whole farm. In 2004-2005 the farm produced 200kg/ha CW (the Northland average) and in 2005-2006, 267kg/ha CW, but their results from the first 50ha of TG have been 900-1100kg/ha LW (450-550kg/ha CW) over the past four farming years.

The farm is on steeply rising hills, a most unlikely place for TG. It receives 2300mm of evenly spread annual rainfall, and rises to 450m. Soil types are a mix of clay and bouldery complex with moderate fertility levels on the main area but low on the new blocks. The farm's layout is a patchwork of 10 adjoining TG systems separated by some rough gullies, knobs and volcanic boulder fields. Ron McCloy feels that even the rockiest paddocks can be included in a TG system. The 10 systems are a mix of multiplexes and single lanes and total 122ha, or just under half of the home farm 250ha. The first TG in 2002 was 20ha of four lanes and 60 cells/lane. It is also the most irregular layout, to avoid wet patches and preserve regular cell size. He can run a lane fence right through a swamp or rocky outcrop and tolerate a small grazing loss in just one day of many. Net liveweight gain has steadily increased from 954kg/ha in 2002 to 1100kg in 2005-2006. Ron and Chrissy use TG on country that is usually considered unsuitable for such systems, running 450 (rising one-year) and 212 (rising two-year) bulls on the hillsides.

The McCloys rear 600 calves on home milk, supplementary powder and pellets over a year. They operate a once-a-day milking system on a 20ha dairy TG in 0.25ha cells, with twice-a-day shifting. Milk is transferred 500 litres at a time into a mobile calf feeder and is driven a short distance to the calf barn. Calves are fed milk until 65kg LW and then supplementary pellets and hay until 90-100kg and weaning. The McCloys calculate that rearing calves saves around NZ$100/head compared with buying 100kg LW weaners. When calves are 100kg they will graduate to a calf TG.

The McCloys believe TG can run large stock numbers forever. No drenching is done unless the animals need it, and only half the drenches are used on the TG compared with the old paddock grazing.

Conclusions

The TG system has proved itself by other farmers successfully adopting it to other livestock types in a wide range of farming situations. Cost-benefit analysis of traditional and TG systems for beef finishing (Ogle & Tither, 2000) found TG markedly boosted returns on total capital invested. Some exciting TG productivity benchmarks have already been set, but there is still room to enhance the system's capacity.

Intensive farming is usually associated with machinery, chemicals, fertiliser and heavy energy use, nitrate leaching, animal stress and soil damage. Though TG is intensive in the general sense, and can be practiced intensively, there is no reason for farmers to do so. Pasture-based livestock farming can be relatively natural, healthy, safe and sustainable, and TG in particular offers these benefits.

References

Brougham, R.W., Causley, D.C. and Madgwick, L.E. (1975). Pasture management systems and animal production. *Proceedings of the Ruakura Farmers Conference,* **1975**: 65-69.

Brougham, R.W. and Cosgrove, G.P. (1985). Pastures and pasture management for high animal production in New Zealand. *Proceedings of the XV International Grassland Congress, Kyoto, Japan:* 1134-1136.

Cosgrove, G.P., Clark, D.A. and Lambert, M.G. (2003). High production dairy-beef cattle grazing systems: a review of research in the Manawatu. *Proceedings of the New Zealand Grassland Association,* **65**: 21-28.

Jones, M. (1933). Grassland management and its influence on the sward. Part 1. Factors influencing the growth of pasture plants. *Empire Journal of Experimental Agriculture,* **1**: 43-57.

Jones, M. (1933). Grassland management and its influence on the sward. Part 2. The management of a clovery sward and its effects. *Empire Journal of Experimental Agriculture,* **1**: 223-234.

Ogle, G. and Tither, P. (2000). An analysis of the risks and benefits of beef intensification. *Proceedings of the New Zealand Grassland Association,* **62**: 25-29.

Rhodes, A.P., Mackay, A.D., Lambert, M.G., Krausse, M.K., Willis, B.H. and Withell, B. (1999). Dirty Habits – a basis for developing sustainable productivity. *Proceedings of the New Zealand Grassland Association,* **61**: 79-83.

Taylor, M. (2001). Income of $2000/ha in Hawke's Bay. Article in *The New Zealand Farmer,* **123**: 18.

Voisin, A. (1959). *Grass productivity*. Publ. Crosby Lockwood, London. 1959. pp353.

Development of the Scottish Monitor Farms Programme

[1]Johnny Mackey and [2]Iain Riddell
[1]*Technical Projects Manager, Quality Meat Scotland, Rural Centre, West Mains, Ingliston, Newbridge, Midlothian, EH28 8LT*
[2]*Select Services Group Manager, SAC, FBS Perth, Sandpiper House, Ruthvenfield Road, Perth, PH1 3EE*

Background

The Monitor Farms Programme (MFP) is now well established in Scotland with twelve farms successfully operating under this banner – ten livestock and two arable. The concept hails from New Zealand where it has proved successful in encouraging the widespread adoption of new, successful farming techniques. Monitor farms are normal commercial farms, representative of enterprises and conditions in their local area, where the farmer is prepared to allow other farmers access to the farm; and to the decision-making process. The other farmers can then assess changes made on the Monitor Farm and are encouraged to adopt the successful ideas themselves.

<u>Aims of the MFP</u>
The aim is to use the Monitor Farm as an example that will motivate other farmers to:

- Improve the physical and financial performance of farm businesses, using the whole farm business planning approach adopted on the Monitor Farm.
- Influence farmer's attitudes to change and encourage a more rapid uptake of best practice ideas, by trying these out on the Monitor Farm.
- Encourage farmers to record data, benchmark their performance against others, and identify ways to achieve better performance.
- Encourage farmers to set specific goals, objectives and budgetary targets.
- Encourage the development of systems that reduce production costs, improve physical and financial performance and free up more management time.
- Increase awareness of methods to improve market returns and ways of adding value.

<u>Funding of the MFP</u>
Quality Meat Scotland, the red meat levy body in Scotland, are the core funders for the Monitor Farms Programme through their R&D programme. Scottish Government and Scottish Enterprise also contribute significant funds with the remaining funds coming from more local sources depending on the location of the Monitor Farm. The funding is attributed three ways – approximately two thirds covers the costs of the professional facilitator, with the final third being

split between the costs of specialist speakers and analysis. It is important to note that the Monitor Farming business does not receive any direct payment.

How do monitor farms work?

The real strength of a Monitor Farm is that principally the local farming community selects the business. The main criteria for selecting a Monitor Farm is that the business in question is typical of the local area, there is room for improvement and that the farmer is willing to take ideas on board to improve the overall performance.

Once the Monitor Farm has been selected, the facilitator advertises for free membership of the Community Group (CG). This group will mainly be formed of farmers from the surrounding area and will also include associated trade representatives such as the farm vet, banker, and accountant, feed supplier, auction mart and abattoir. Given the regular discussions of animal health issues within the MFP, inclusion of the local vet in the CG is now seen as essential. The CG set the short, medium and long-term objectives for the Monitor Farm in the first two meetings and then meet six times per year over the next three years to work on those objectives for the greater good of their local farming economy.

<u>Financial issues at monitor farms</u>
As one of the principal aims of the MFP is to improve the financial performance of the business in question, work on the finances around the Monitor Farms has been extensive. The willingness of Monitor Farmers to allow others access to their accounts has been a big plus and helped everyone's understanding of financial issues. It is a brave step to present a set of accounts for scrutiny by others, and we are greatly indebted to our volunteer Monitor Farmers for their openness. The whole farm approach also creates the opportunity to look at each enterprise and its contribution to the bottom line. The more open the Monitor Farmer is, the more others will get from the project, but it also works the other way. The more open the Monitor Farmer is the more they will expect others to do the same.

There is one golden rule. Sensitive information discussed within the group stays within the group. To get round this issue, data is presented as percentages rather than absolute figures, allowing some of the discussion to be broadcast for the benefit of a wider audience.

This section gives an opportunity to see how other sets of accounts compare to some of the Monitor Farms. Of course the bottom line can be influenced by other factors such as the weather, price fluctuations, changes to the support regime and so on but this at least gives a starting point.

Borders Monitor Farm

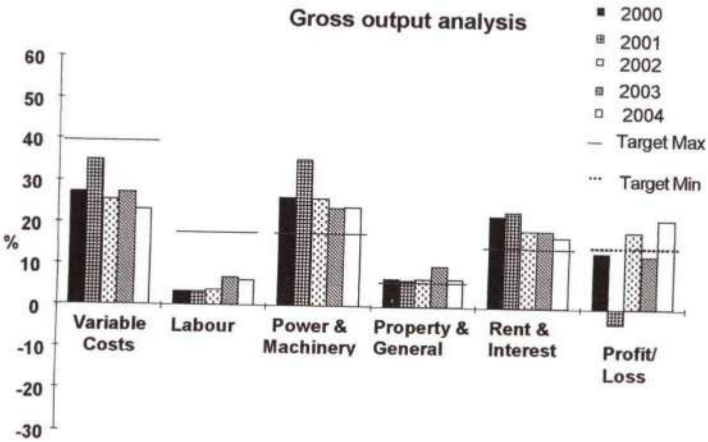
Table 1 shows four years accounts analysis for the original Borders Monitor Farm at Lilliesleaf. Variable costs are well under control and the level of gross margin shows that the business was technically efficient. The only exception is 2001 when lamb prices were so low, reducing output and making costs look higher. Fixed costs came close to meeting target in 2002 and 2004, a commendable achievement given the fact that most land is rented, and the business is relatively young. Net profit exceeded target of 15% in two years.

Table 1. Accounts analysis for the Borders Monitor Farm by production year

	Percentage of gross output				
	2001	2002	2003	2004	Target
Gross output	100	100	100	100	100
Variable costs	37	26	27	23	30-40
Gross margin	63	74	73	77	60-70
Fixed costs	67	55	60	55	45-55
Net profit	-4	19	13	22	>15

The analysis illustrates the variability of farm incomes from year to year often due to factors outside farmers' control. The Monitor Farm project is all about improving the aspects of production that are within a farmer's control. 2005 figures were also analysed but the combination of some subsidy payments and delayed payment of Single Farm Payment (SFP) made direct comparison difficult and for these reasons they have not been included in this summary.

Figure 1. Graphic representation of Borders Monitor Farm accounts analysis



Comparison with accounts from 3 other local farms

Taking this a stage further, accounts were then compared with those for three other similar farms in the Borders, from volunteers within the Community Group. This was rated the most useful session held at a Monitor Farm meeting. The aim was to improve peoples understanding of accounts and to benchmark the Monitor Farm with similar businesses in the group. Results can be seen below. Accounts were analysed for the 2004 crop year.

Table 2. Comparison of three sets of accounts with the Monitor Farm

2004	Monitor farm	Farm A	Farm B	Farm C	Target
Gross output					
Crops (%)	10	38	31	21	
Cattle (%)	25	27	0	35	
Sheep (%)	59	30	60	34	
Other income (%)	6	4	9	9	
Output (%)	100	100	100	100	100
Variable costs (%)	23	22	27	32	30-40
Gross margin (%)	77	78	73	68	60-70
Labour (%)	5	9	0	9	15-18
Power machinery (%)	25	21	37	32	15-18
Property (%)	3	4	8	1	
General (%)	4	3	8	8	6-8
Rent & interest (%)	17	19	0	7	15
Fixed costs (%)	55	60	53	57	45-55
Net profit (%)	22	24	20	11	min. 15

One of the most useful benefits from this exercise was to discover that their accounts were not that much different from other members. All had relatively low labour costs, but were well over target for machinery costs. Combining both labour and machinery however got all of the businesses within target. Both the Monitor Farm and Farm A had high rent and interest figures due to the fact that they were tenancies.

For the next exercise the group members were split into three groups and asked to look at the Monitor Farm's machinery list and identify where any savings could be made. The biggest part of the valuation comprised a car, the farm truck and a tractor, with all other items at less cost. None of the groups were able to identify any items that could be considered a luxury. The best suggestion was that the Monitor Farm could do a deal with an arable farmer to do the spraying and fertiliser spreading (all other arable operations are done by contractor). The conclusion was that the Monitor Farmers were doing a very good job and had kept costs relatively low.

Wigtownshire financial analysis

Full details of the Profit and Loss Account from the original Wigtownshire Monitor Farm, before the stage of deducting rent and interest payments, can be seen in the following table.

Table 3. Analysis of four sets of accounts from Wigtownshire MF

	Percentage of gross output				
	2002	2003	2004	2005	TARGET
Gross Output	100	100	100	100	100
Variable Costs	34	30	27	42	30-40
Gross Margin	66	70	73	58	60-70
Labour	11	13	11	8	15-18
Power	26	20	23	18	15-18
Overheads	11	13	16	10	4-6
Profit before rent/finance	18	24	23	22	***Min 30***

Output increased steadily over the four-year period and the Single Farm Payment contributed 25% of this by 2005. Variable costs had been falling, but rose in 2005, largely due to expenditure on feed, seed and fertiliser almost doubling, to fall just outside the target range at 42% of gross output.

Wages at 8% of output were well below the target of 15-18%. Machinery repairs coupled with depreciation contributed to the spend on power and machinery, which was 18% of output and close to the target, but still suggested room for improvement. General overheads accounted for 10% of output in 2005 (against target of 6%) and include property repairs and expenditure on fencing and drainage.

The group concluded that only fine-tuning was required going forward – variable costs should come back in line, as part of this increase in 2005 was one off expenditure on lime.

Net margins for individual enterprises

After decoupling many Monitor Farm groups looked at the individual net margins without support payments of each enterprise on the farm. Accepting that support payments are an integral part of the whole farm accounts, it is possible to compare the returns from different enterprises and fine-tune the system.

A classic example of this was on the first North Argyll Monitor Farm when the autumn calving cows left a considerably lower margin than the spring calvers. The Community Group recommended that the autumn herd be sold and the spring herd increased.

Table 4. Net margin figures for two herds on North Argyll MF

	Spring	Autumn	QMS av. 2003
Net margin	62	-81	32
Less support payments	-143	-372	-148

The figures can also help inform on the fragility of farming in remoter areas. The second North Argyll Monitor Farm is a well-run unit, but is heavily dependent on Single Farm Payment (SFP), LFASS, and Agri-environment schemes to turn in a profit on farming operations. This is a case of the Monitor Farm informing others or acting as a barometer for farms in the area, which is of interest to policy makers.

Figures produced by SAC facilitator Niall Campbell showed that the sheep enterprise net margin, excluding support payments and including all costs, was a hefty loss of £54 per ewe. Adding in a share of SFP, LFASS, Land Management Contract payments, and Agri-environment payments converted this to a small profit of £8.14 per ewe.

Sheep numbers are reducing in the north and west Highlands, which has serious implications for employment in the area, as well as environmental and landscape concerns. One of the aims of the Monitor Farms Programme is to address these concerns and come up with practical solutions.

The Buchan Monitor Farm has probably made the most changes to production after analysing performance figures in Year one. Heifers that were grazed for a second summer are housed from weaning and finished on an *ad lib* cereal diet; herd fertility has been improved through cow and bull management; and health planning has been undertaken to minimise the impact of disease. This was already a well-run unit but the Monitor Farmer freely admits that the project has helped quickly focus in on areas requiring attention. The following table shows how performance has improved and how the Monitor Farm exceeds QMS survey data for rearer finisher enterprises.

Results (Table 5) are shown for calves born in 2005 and finished in 2006 (2005) and those born in 2004 and finished in 2005 (2004) for the spring calving herd only. The Monitor Farm performance is particularly impressive, and encouragingly continues to improve.

Table 5. Analysis of two years accounts from Buchan MF

	Monitor farm (£/cow)		QMS Rearer finishers
	2005	2004	Average 2004
Calf output	757	635	560
Support payments	38	255	294
less net replacement cost	-44	-41	-58
Output	**751**	**848**	**796**
Purchased concentrate	15	19	89
Homegrown concentrate	113	61	53
Other feed	27	39	26
Forage	37	30	44
Total feed and forage	192	149	212
Vet and med	47	38	22
Bedding	36	31	43
Other costs	36	26	17
Total variable costs	**312**	**244**	**294**
Gross margin	439	604	502
Fixed costs	457	437	422
Net margin	-18	167	80
Net margin less subsidies	-56	-90	-214

Feedback on the MFP

To date only anecdotal feedback through direct communication and some short surveys carried out by the facilitators is available. For example the North Argyll Monitor Farm surveyed its community group to discover that 91% of the group had implemented ideas generated on the Monitor Farm in their own business. Personal communication with dozens of farmers involved in the programme via the community groups suggests that they find the meetings, and subsequently generated reports, extremely useful to their businesses. The reports loaded onto the QMS website are some of the most visited pages on that site. The Monitor Farm work reaches a much larger audience through regular press articles and through use of the information at meetings around the country. Feedback from those not attached to Monitor Farm groups has also been positive.

In order to provide some independent analysis on the effectiveness, or otherwise, of the Scottish Monitor Farms Programme, QMS and Scottish Government have commissioned an evaluation of the MFP which is due to report in September 2008.

Future Development

Future development of the MFP will very much depend on the findings of the review referred to above. There are some obvious geographical gaps in

Scotland (Dumfriesshire, Lanarkshire, Stirlingshire, Caithness, Orkney) in which groups of farmers are starting to request that they be allocated their own Monitor Farm.

Conclusions

The Monitor Farm Programme has for the first time given farmer's access to good, reliable physical and financial information for individual farms, which is freely available. The information gathered from the MFP allows the industry to:

- Compare farm accounts against the Monitor Farms;
- Compare enterprise performance against the Monitor Farms;
- Glean practical information that fellow farmers have used to improve performance on their farms.

There is no substitute for joining a Monitor Farm community group, however if this is not possible, then all reports can be accessed on the Monitor Farms Programme pages in the QMS website – www.qmscotland.co.uk/monitorfarms

Essential steps to successfully investing in the stock market

Ardle Culleton and Susan Hayes
37 La Touché Park, Greystones, Co. Wicklow

Introduction

Investing in the Stock Market can be easy to do and very rewarding. It is an established fact that markets rise over time and one way to win in the stock markets is to buy business value when it's available. In this paper, we endeavour to explain through five easy to follow steps, the most effective way of achieving stock market success. During the course of the paper, the different procedures an investor will need to adhere to are explained are as follows;

- Know 'who you are' in the market;
- Take volatility out of the market;
- Follow a logical, easy to understand and time tested strategy;
- Keep brokerage costs low;
- Let the power of compounding work its magic.

Know who you are in the market

In the market there are both investors and speculators, and before participating, it is important to identify which one you are. A speculator may have some of the following trading characteristics; active buying and selling, short term bets, uses technical analysis to examine companies, contracts for difference accounts, spread betting etc. An investor is very different, as this type of an individual will use fundamental analysis i.e. look at a firm's cash flows, yield value ratios, and undertakes logical, time-tested strategies and is committed to remain in the market for the medium to long term. It is extremely difficult to be a speculator and emerge with a positive return, for two reasons. Firstly, a commission must be paid each time one buys and again when one sells. If an individual is making frequent short term bets, these commissions will quickly eat in to profits and diminish them substantially.

The poker analogy illustrates how difficult it is to make a consistent gain in the short term. Imagine four people sitting around the table playing poker - by the end of the evening, two people will have won and two will have lost but no new money leaves the room, it is simply a zero sum game. The gains the two winners make arise due to the losses of the two other participants. This is very similar behaviour to speculators who are in the stock market for short-term plays. A business could not hope to have growth rates consistently of 5% (or even 1% daily), and if it did it would rapidly meet with production capacity problems. Consequently, the only way to make money in the short term is to be at the opposite of another's loss. It is arguable that a good speculator can take advantage of some good short-term bets and this is true. However, we live in an 'Information Age' where professional investment institutions have access to second by second stock market news from companies like Bloomberg and Reuters. These professional investment institutions will spot an arbitrage opportunity and make use of it long before an amateur has even heard the news flow. As a result, similar to the poker game, what the speculator may gain in one short term bet, they are almost certain to lose on another one and have to pay two commissions to boot each time, driving their profits potentially into the red and their head into the sand.

The investor has a much higher chance of success. Firstly, he/she is investing in companies based on fundamental analysis, and hence will buy firms that are offering good value in the medium to long term. It is an established fact that markets rise over time as society trades and economies develop. For instance, the S&P 500 has grown 11% compound per annum (cpa) since 1970. This is an index that is made up of the five hundred richest companies in America and accounts for 80% of the market capitalisation of all stocks listed on the New York Stock Exchange. This is one example of many that stock markets rise over time.

In addition, investors undertake logical, time tested and easy to follow strategies. If an individual has a good approach that has these characteristics, they have clear, defined guidelines so as to maximise their returns without letting emotion lead them to speculators' pitfalls.

Take volatility out of the market

It is impossible for anybody to predict with consistent accuracy, which way the market will move. So instead of trying in vain to time the market, one can eliminate volatility in so far as it is possible from an individual's perspective. In the short term, the stock market is an "irrational beast" - it reacts wildly to positive or negative news flows, which can drive share prices apart from the intrinsic value of the company, which is both the cause and effect of unpredictability. However, if an investor engages in a regular investment plan, they can deal effectively with this issue. If the market falls, the buyer can invest at a lower price and as pointed out earlier, the market will rise over time. As a result, the individual does not have to attempt to time the market, but nonetheless deals with volatility effectively.

The SSIA Experience in Ireland from 2001-06 is an excellent example of how this theory works in practice. Figure 1 illustrates that the European FT Euro-First 100 index was higher at the beginning of the SSIA timeframe than at the end of it; therefore if an investor had put a lump sum into this particular market in May 01, it would have produced a negative return by the end of the five year period. However, if this same person had bought the equity based SSIA that tracks the same market and regularly invested the maximum amount of €254 each month at the market rate; they would have emerged with a tidy profit

(Figure 2), due to dollar cost averaging. E.g. if a lady invests €254 when the fund price is €10 per unit, she can purchase 25.4 units. If the price drops to half of its value i.e. €5 per unit, she can buy 50.8 units. Consequently, her average price is not €7.50 per unit, but €6.67 since she was in a position to buy a larger number of units at the lower price. Similarly, in the Euro land Unit linked fund SSIA product, the investor could buy double the amount of units in Jan 03 than Sep 00, with the same amount of money. As a result, it only takes a small upside for the investor to be back in profit. This explains the success of the SSIA's, and also the reason that equity based SSIA's outperformed cash deposit products despite two of the worst years in the past thirty-five years in the stock market.

Figure 1. FT – Eurofirst Index (May 2001 – May 2006)

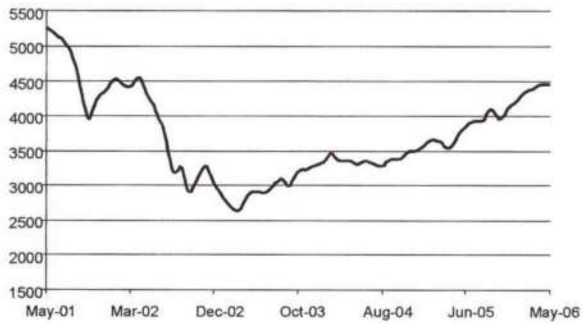
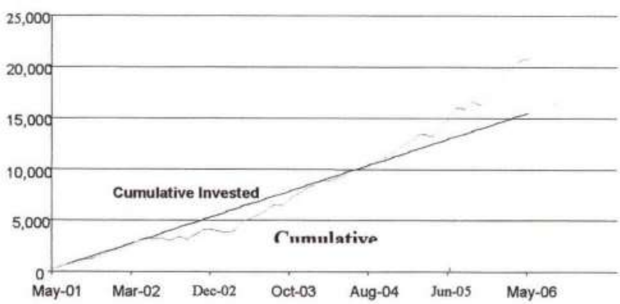


Figure 2. SSIA – New Ireland Euro land unit equity fund (May 2001 – May 2006)



Follow a logical, easy to understand and time tested strategy

The third step to stock market success is to have a logical, easy to understand and time tested strategy. After deciding which type of market participant one 'falls into', as well as understanding how to take volatility out of the market, the next crucial move is to decide what to put into the investment portfolio. It is all too easy to take uninformed "tips" from speculators or brokers interested in making commissions. However if one really wants to become informed as to picking a selection of stocks, it is of paramount importance to develop a winning strategy.

Important features of a strategy

There are certain criteria that define a successful strategy including;

- A good, long term, performance record;
- A portfolio of shares with a minimum of ten stocks;
- Guidelines pertaining to what to buy and when to sell;
- An easy to follow and understandable rationale underpinning the stock selection.

<u>A good, long term, performance record</u>

It is important for a strategy to have a good, long term; performance record, i.e. a record of unbiased performances for at least a twelve year period where the overall return has outperformed the market in aggregate over that timeframe. The reason that this particular length of time is chosen is that in general, any given market will see both bull and bear periods and hence will give a balanced view on the strategy performance itself. Consequently, if one has faith in their chosen approach, they will have the conviction to stick with it during volatile periods and hence remain in the market until the portfolio recovers in the knowledge that it has survived bear markets in the past. In addition, as explained in the previous section, the majority of 'investors' can't time the markets so they won't know when a downturn or upturn will occur. As a result, it is imperative that a strategy has a proven track record over the different types of market conditions; so that the individual is satisfied that it can survive tough times.

<u>A portfolio of shares with a minimum of ten stocks</u>

It is of great importance that an investment portfolio has a spread of companies, so that if one or two fall in value, this does not have an unduly negative effect on the average return. Thus, in a portfolio of ten stocks, should one or two fall in value, there is still a significant number of shares to neutralise this effect.

<u>Guidelines pertaining to what to buy and when to sell</u>

Without doubt, this is an absolutely crucial characteristic of a successful strategy. If the investor has any ambiguity regarding what to buy or when to sell, there is room for emotion to enter the equation and misguide their stock selection process. An approach must provide a comprehensive and complete set of criteria defining "what to buy" and also impart a timely selling signal indicating "when to sell" to the investor.

An easy to follow and understand rationale underpinning the stock selection

If a strategy is full of complicated and time consuming conditions, it is easy for an amateur to misinterpret instructions and/or lose interest. As a result, it is essential that one can follow and comprehend without difficulty why they choose to add stock to their portfolio. In addition, if a stock price falls, the individual need not worry unduly as they know why the stock was bought in the first place, and will be in a position of knowledge as to when to sell it.

Stock selection using qualitative or quantitative factors

Fund managers may use qualitative factors i.e., quality of management, product positioning, economic outlook etc., or quantitative factors (numbers based), i.e., Price/Earnings Ratio, Price/Cashflow Ratio, Dividend Yield, Return-On-Capital-Employed, Earnings Yield etc., in their stock selection. For the amateur investor, the qualitative factors can be ignored - the reason being the professionals will interview management such as C & C, their customers and competitors, and try to make an overall forecast/prediction. It's well known that the majority of fund managers prefer to use this method, but many get it wrong as they have a misguided belief that they can predict the stock market. Those that get it right are the chosen few like Warren Buffett and George Soros. In order to empower the individual to be able to choose a successful portfolio themselves, it is sufficient to use a completely numbers based approach (for example, the ISEQ Market strategy detailed below). There are several valid reasons to use a quantitative approach including, an absence of subjectivity, easy access of quality information and emotion is eliminated from the stock selection process.

The ISEQ (Irish market) strategy

The ISEQ (Irish Market) Value Approach is based on good business values; it has worked well over time (time-tested) and is relatively easy to follow. In essence this approach takes advantage of the market's natural tendency to over-react to negative information. By adopting 'Time-Tested' approaches to selecting stocks in an unemotional way using quantitative factors, investors are essentially forced to buy low when extra value is on offer. It is that extra value purchased that delivers the extra returns (on average) over time to the individual. The two numbers based factors used in this methodology are High Return-On-Capital-Employed (ROCE) and High Earnings-Yield (EY). In effect, the ROCE shows how profitable a company is and the High EY captures companies that are essentially "on sale". During the period of 1995-2007, this strategy has returned 24.5% cpa in comparison to the Irish market (ISEQ), which has returned 13.6% cpa over the same period. A €10,000 investment in the ISEQ Value Approach would have compounded to €173,000 (before costs) over this 13-year period. The same €10,000 invested in the ISEQ index grew to a lesser amount of €52,000. This strategy has 12/13 stocks in its portfolio at any one time, which ensures good diversification across the Irish market and hence has built in protection to minimise risk. The highest combination of the ROCE and EY of the Irish market creates the current picks list of the aforementioned 12/13 stocks; hence there is a very clear, defined plan in place addressing the question of "what to buy". In addition, there can be no doubt regarding "when to sell" – if and when a stock no longer fits the strategy, the company is then removed from the portfolio and replaced by the new share that does meet the criteria. As a result, the investor has a solid framework and they have no uncertainty as to what to buy and when to sell. It is also noteworthy that this particular strategy has very little turnover and therefore keeps costs low (the importance of this is stressed in more detail in the next step). This is not a time consuming exercise, in fact, it only needs about two hours per year, due to the small number of trades required. In order to acquire the information there are a number of options including; the data can be ascertained from the companies' financial statements which can be tedious or it can be found in the www.investlikethebest.com website at a low cost which is updated weekly. Consequently, an amateur investor knows exactly "what to buy" and "when to sell", and hence does not have to rely on the recommendations given by brokers who would prefer their clientele to be active in the markets, so they can receive more commissions. In summary, the market consistently over-sells companies experiencing pessimistic news flow; however, this methodology ensures that the investor is, on average, buying profitable companies in the Irish Market at good value.

Collective investment products

A strategy comprising individual stocks may not be for all types of investors and so there are several collective investment products available. By definition, a collective is a fund containing several stocks, e.g. Exchange Traded Funds (ETFs) and Investment Trusts. ETFs are the fastest growing product in the world - they act like a fund and trade like a share, hence an investor incurs one commission on adding it to his/her portfolio. An ETF's defining characteristic is that it tracks a specific index product such as the Irish market, the FT100. It can also track commodities like gold, silver or soybeans. For example, the ISEQ 20 Tracker is an ETF designed to track the ISEQ twenty and mirror its returns - buying this single product will provide automatic exposure to the top twenty stocks on the Irish market, and is a low cost method of achieving diversification. In addition, some funds can be put into an Investment Trust. This is a company set up to solely invest in other companies, for example, Gartmore Irish plc is an Investment Trust that employs a fund manager to pick out the best stocks in the Irish market and wrap them up in a fund to be traded on the stock market. Apart from active management, an Investment Trust carries the same characteristics as an ETF, i.e. low cost method of achieving diversification etc.

Keep your brokerage costs low

The information supplied in this paper is futile unless implemented. In order to actually buy and sell shares, one needs to set up an account with a broker who acts as a medium between them and the market. There are two types of broker, namely traditional and online discount. Some examples of the big name traditional brokers include Davys, Goodbodys, Merrion Capital etc. The purpose of these companies is to take an order from you and then proceed to execute the trades on your behalf. Some of these firms have set up an "online trading" facility, but this is not discount brokering, rather they establish an email relationship with their clientele as opposed to dealing with requests over the phone. An online discount broker (e.g. E-Trade ODL and Sharewatch) is in existence to offer a cheaper method of trading but the investor makes a more hands on contribution to the trading activity. At the moment there are none of these companies based in Ireland, but one can successfully set up an account with a UK or US online broker and use their trading software to buy and sell shares. It is noteworthy that both types of brokers provide advisory and execution only facilities. An execution only account simply involves the individual placing the trade with the broker. An advisory account is where the broker gives recommendations and executes trades – this service costs more.

There are many questions that one should ask potential brokers when shopping around, as there can be vast differences between them in terms of value and service. Also brokers can have many other hidden charges that can potentially eat into returns. The following are a list of useful queries when deciding to open a brokerage account.

- Are there set up fees?
- Are there any account maintenance fees and if so, what are they?
- If one wants to buy a stock denominated in a currency other than their domestic, how much will the FX (Foreign Exchange) cost in order to transfer your money into that currency?
- Are there any minimums involved in trading with the broker?
- Are there any markets that the stockbroker will not trade on an individual's behalf?

On selecting a broker, the investor needs to set up an account and then buy the stocks that fit their chosen strategy. There is no more action needed from the individual at this stage apart from the patience to let the power of compounding work, as will be discussed in the next section

Let the power of compounding work its magic

The power of compounding cannot be over emphasised and will be illustrated below by means of an example;

Investor A saves €2,000 per annum from the age of 25 and stops saving at the age of 32. A theoretical 10% return per annum is received until age 65. Investor B starts at the age of 33 and saves €2,000 per year until he is 65, and gets the same 10% return per annum. Which of the two has the most saved at age 65?

The answer is Investor A, who only invested for 8 years. The reason for this is that Investor A started to invest at age 25 and his money also began compounding at that age. By the time he is 32, his money had grown to the point where it was generating over €2,516 each year. However at this stage, Investor B is only starting at €2,000. The money is compounding at the same rate, but since Investor A has gained the head start on Investor B, he simply cannot catch up in the time given.

This result is worthy of some comments - firstly, don't hold back - start now! As illustrated above, the longer a person is in the market, the more time you are allowing your money to work for you. Secondly, again in favour of the investor, if somebody has the patience to stick with a strategy and not interrupt it with active buying and selling, their money can grow without several commission charges continually deflating the profit. Finally, if an investor chooses a good, solid underlying portfolio of stocks, he/ she can put these into a medium to long term plan and simply hold and let them compound into the future until they are called upon. An individual does not need a large lump sum in order to start this process – some suggestions may be to set up a regular savings plan with child benefit or initiate a monthly contribution to a self-administrated pension. In both cases, the money is usually set-aside for the future beyond the short term. Instead of leaving these sums of money on deposit, one could certainly create a regular savings plan following a time tested strategy for the power of compounding to work over a significant timeframe.

Conclusion

In summary, each of the five steps needed to become a successful investor in the stock market have been detailed. Each phase requires a level of effort on behalf of the individual, but the most important requirement is to get training. Stock market success is a choice for everybody - as opposed to a secret for an elusive group.