Irish Grassland Association Journal

2003 VOLUME 37

IRISH GRASSLAND ASSOCIATION

CORPORATE MEMBERS 2003

ACC Bank
AIB Bank
Alltech
Bank of Ireland
Bord Bia
Connacht Gold
Dairygold
Dairymaster Limited
Dawn Meats
Drinagh Co-op
Drummond Seeds Limited
FBD Insurances
Glanbia
Goldcrop Limited
Grassland Fertilizers Limited
I.A.W.S Group plc
IFAC Accountants
Irish Farmers' Journal
Irish Farm Managers Association
Kerry Agribusiness
Lakeland Dairies
LELY Ireland Limited
McQuinn Consulting
Monsanto Ireland Ltd
Mullinahone Co-op
New Zealand Cattle Limited
Pharmacia Animal Health
Premier Molasses Company Limited
Timac Limited

TEAGASC EDUCATION and ADVISORY SERVICES

Ballyhaise Agricultural College
Cork East
Cork West
Laois
Limerick
Regional Office, South, Kildalton
Regional Office, North, Grange
Tipperary North
Tipperary South

Irish Grassland Association

JOURNAL

Vol. 37 2003

Edited by
David McGilloway

ISSN 0332-0588

Printed by Walsh, Printer, Roscrea

CONTENTS

COUNCIL 2003 – 2004

President	Tony Pettit
Vice-President	Brendan Barnes
Past-President	John O'Brien
General Secretary	Grainne Dwyer

John Claffey, Kevin Commins, Noel Culleton, Jim Dwyer, John Dunworth, Donal Fitzgerald, Sean Flanagan, Jan Frederiks, Padraig French, Mark McGee, James Humphreys, Anne Kehoe, Pearse Kelly, Jack Kennedy, William Kingston, Pat McFeely, David McGilloway, Michael O'Donovan, Robin Talbot, Padraig Walshe, Peter Young

Irish Grassland Association, Moneymore, Borris in Ossory, Co. Laois

Phone/Fax 0505 41025 Email: grassland@eircom.net

New Zealand sheep farming

P. Clarke[1] & G. Scully[2]
[1]*Teagasc, Kildalton, Co. Kilkenny*
[2]*Teagasc, Athenry, Co. Galway*

Introduction

New Zealand (NZ) is four times the size of Ireland (Ire), and has a total population of close on 4 million people (the same as Ire). The main natural resources are the people, the land and the sea. Farming is the mainstay of the economy, with agricultural exports accounting for over 90 percent of revenue earned.

New Zealand agriculture is based on 4.6 million dairy cows and 30 million breeding ewes. There are virtually no suckler herds or cereal cropping. Having come through a very tough period in the mid 1980's when all subsidies were removed, farming has bounced back to be a strong industry today. Product prices are well below those in Ire, but the NZ cost base is much lower. There are no milk quotas. To begin milk production in NZ, a farmer must make an initial payment to the co-op of about €1.30 per gallon of milk produced. The co-op uses this fee to provide the facilities to process the milk.

There are virtually no in wintering farm buildings in NZ other than milking parlours, shearing sheds and covered sheep handling units. Animal's stay out all year round so feeding is grass based. All farms are well fenced and organised. The most common machine is the quad bike, with over 70,000 in NZ.

Root crop acreage is again increasing; turnips to overwinter cows, ewes and store lambs, and stubble turnips and other green crops for finishing lambs. Some round bale silage is also made.

Pollution is an issue of increasing concern. To set up a new milking unit, a farmer must first go to the neighbours and get them to sign off that they are happy that there will be no interference with their water supply. This is a form of planning permission and there are Environment Courts that adjudicate in the case of a dispute.

New Zealand has long been associated with new technology and this is evident on farms. Farmers highlight the Internet and quad bike as bringing major changes to their lives. A low cost base, rationalisation at farm and processor level, plus strong marketing worldwide has all contributed to the present good fortune of NZ farming. Obviously, given that so much has to be exported the value of the NZ dollar is important. A weak NZ dollar greatly helps exports.

Sheep

Numbers

In the early 1980's, the NZ ewe flock stood at 50 million breeding ewes. Today the figure is 27 million head. In 1980, lamb carcass weight was 13 kg; today it is almost 17 kg (see Table 1). In addition, the average weaning rate has gone from below one lamb/ewe to the present 1.16 lambs/ewe. Even though ewe numbers have dropped by 32 percent, overall weight of lamb carcase produced has increased by about 3 percent. This is a massive turnaround by any standards and shows how sheep farmers have become more efficient and adapted to survive without subsidies.

Table 1. Breeding ewe number, lamb carcass weight, weaning rate and total lamb output for 1983 and 2001

	1983	2001
Breeding ewes (million)	51.0	30.3
Lamb carcase weight (kg)	<13	16.8
Weaning rate	0.98	1.19
Total lamb output (000t)	600	600

Source: Meat New Zealand

Wool

Of the 30 million breeding ewes in NZ, some 3 million are Merinos and the rest are based on the Romney. The Merino sheep is a hill breed and producer of good quality wool. The fleece from a Merino can weigh up to 6 kg, twice that of a Suffolk in Ireland. Merino fleeces have a fibre diameter as low as 16 microns whereas fleeces in Ireland would have a diameter of 28 – 30 microns.

Falling wool prices have hit NZ as well as everywhere else. Just a few years ago, wool accounted for 34 percent of total sheep output; today it is just 16 percent. This is forcing a change in emphasis from wool to increased lamb output.

Grass

Grass is the cornerstone around which NZ sheep farming survives. There is no meal feeding. Grass is saved up for their shorter winters and rationed out to ewes during pregnancy. Ewes are set stocked three weeks before lambing and allocated grass depending on whether they have singles, twins or triplets. Farmers talk about kg of grass DM per hectare in the same way as farmers in Ireland are familiar with cereal yields. In NZ grass growth is planned and budgeted, it is their main source of feed.

Breeding

The Romney sheep, which is the most popular sheep in NZ, comes form the Romney Marsh breed in Kent, Southern England. A white-faced sheep, the mature body weight is about 65 kg. Like the Merino, it can produce a fleece of up to 6 kg but the fibre diameter is usually over 30 microns. The Perndale breed (Romney x Cheviot) and the Coopworth breed (Romney x Border Leicester) have developed from the Romney.

Weaning rate is going up with many farmers hitting 140 %. This is being achieved by using composite breeds. About 20 years ago some Texel, Finnish Landrace and East Friesian ewes were brought in to NZ. These bloodlines are now being used to produce a prolific crossing ram (composites), very similar to the Belclare in Ireland. Farmers that have reached a weaning rate of 140 - 150 % do not want to increase this any further, as this results in increased triplets numbers which does not suit an easy care set up.

Terminal rams are selected to produce lambs with good hindquarters and narrow shoulders. NZ farmers argue that the back end is the most valuable part of the carcase and no matter how good the shoulder is, it is still worth very little so why select for it. You are just selecting for difficult lambings.

Work organisation

In NZ you don't attempt to operate without proper facilities. Every farm is superbly fenced with sheep wire or electric fencing, and is equipped with its own post driver and fencing equipment. There is also a big fencing contract business in the country. Gates and grass roadways are strategically designed and located to make movement of animals easier.

All sheep have to be crutched (clipped) before sale. This is potentially a huge job but again the facilities make it easy. The handling units are well designed. Additional features, such as electronic chutes and automatic weighing scales are increasing on units. Labour saving products are widely used e.g. concentrated pour-ons, which can be mixed with water and pumped to a jetter system in a race using a tractor sprayer. Every farm has a special chute for loading animals. All the livestock trucks and trailers have sliding doors. There are no trailer ramps as we have here – they were banned about 10 years ago on safety grounds.

Teams of dogs are a vital element – stamina dogs are used for long distance work, the 'eye' dog for lambing and 'gentle' dogs are used in the handling units. Quad bikes are on every farm.

Lambing is largely unsupervised. At best, farmers try to get around all the flock every 1 – 2 days. There are no foxes in NZ. Likewise there are no grey crows to be seen, which are big advantages when lambing outside.

Processing

Two major meat groups – Alliance and PPCS – account for 80 % of the beef and lamb slaughtered in NZ. Farmers own both. The Alliance Group has reduced their lamb slaughtering factories from eleven down to seven plants – Mataura is the biggest. This plant operates 20 hours a day with four hours down time for cleaning. Daily throughput of lambs is 10,000 head. It employs close on 1,400 people and is a fully integrated unit. Sheep go in at one end and meat comes out vac-packed and labelled at the other end. This product has a shelf life of 65 days - 40 days for shipping and 15 days on display in the supermarkets across Europe.

In NZ, carcasses are being weighed and graded as in Ire, but that is soon to change. Scanner equipment is in its final testing phase and by 2004, farmers should be paid on 'yield of meat' rather than grade. Factories have gone from cutting up about 15 % of carcasses a few years ago to cutting up 85 % of carcasses now (Table 2.). Yield of meat is very important.

Table 2. Percentage changes in further lamb processing for selected years 1981, 1991 and 2001

	Exports in carcass form	Exports as bone in/ boneless cuts
1981	84%	16%
1991	43%	57%
2001	10%	90%

Source: Meat New Zealand

With rationalisation at factory level, moving to cutting of carcasses and improved technology, $NZ 18 has been added to the value of each lamb ($NZ 2 = ≠ 1). All this has been passed back to the farmer. When lambs are sold, farmers get paid 90 % of the quoted price. The remaining 10% is held by the company as an interest free loan. This is then paid at the end of the season plus a dividend.

Traceability

Traceability exists from the farm of origin to the factory, and a declaration required by law has to be signed by the farmer. This relates to disease status and withdrawal periods. There is no traceability from the farm of birth as there is no official tagging of sheep. However NZ export 400,000 tonnes of sheepmeat, 230,000 tonnes of which comes to Europe. Europe is a high price market and so NZ will do whatever Europe wants in order to stay in the market.

Research

Major progress is being made using Biotechnology. DNA testing is being used to identify genes that influence productive traits e.g., number of lambs produced, resistance to disease, fertility in ewes and yield of meat in lamb carcasses or any other quality that is desirable. Instead of trying to select populations of animals as in the past and hope the next generation will have a particular trait or quality – these new methods allow genes be incorporated into breeding programmes and breeds. This gives instant results.

Monitor Farms

A monitor farm is an individual farm chosen by the local community, which a community group advises and monitors over a three-year period. The Monitor Farm programme aims to increase farmer's awareness of key management issues affecting their business, to motivate the farmers to modify their systems to increase productivity and profitability, and to be market driven. In all, there were 31 such farms in 2000, spread across the whole country covering both sheep and beef. Meat New Zealand and Woolpro provide funding for these farms. Meat New Zealand is the company charged with selling/promoting NZ meat around the world while Woolpro is a wool exporting company. Each farm has a community group that meets regularly and discusses how the farm is doing. This community group is made up of farmers, local agribusiness people, advisers, vets, meat factory people and researchers. Discussion groups are built around these farms and the funding provided goes in part to the Monitor Farmers and in part to pay an adviser to run the discussion groups. Looking in at this Monitor Farm model, it is very impressive. There is a huge element of self-help with the farmers themselves as the drivers.

Conclusions

New Zealand farm produce will continue to be a competitor in Europe. They still have very strong links with Europe and particularly the UK.

There are three key messages for the Irish sheep industry;

- Work organisation,
- Biotechnology,
- Value added.

Improved handling facilities are needed on Irish farms. Basic handling facilities should include a collecting area, a dosing race and footbath, plus a place to put a weighing scale are necessary if you have sheep. In Ire the same fencing equipment is available as there is in NZ. A lot of fencing has been done under REPS in the last few years, but alot more needs to be done.

Ireland will need to move fast in the whole biotechnology area. Teagasc are in the process of building new biotechnology laboratories at the main centres. Today in NZ, you can take a tiny pin prick of blood from a rams ear – send it to Lincoln University and got back information on how resistant the ram is to footrot. The new biotech laboratories must be given both the equipment and the scientists to make the advances we need to compete. This applies across the board through dairying, sheep and cattle. Major advances will be made in the next few years using the best genetics – Ire must be part of these advances.

The 'value added' area has to be tackled in Ire. Why can't we be more innovative in developing convenience packs for export? How good are the carcasses we are producing for cutting up? The industry needs feedback. As farmers, that feedback should be demanded. Are the Breed Societies doing the right type of selection? What do we mean by a good ram anymore? The NZ farmers are very tuned in to the exact requirements of the export markets. We are not nearly as close to that information and we don't see it as important as the New Zealanders do.

New Zealand farm size is massive by Ire standards – 2,500 ewes or 400 dairy cows being the basic unit to live on. Scale in Ire will change over time, and there is nothing wrong with part-time farming. Also, Ire is only 20 – 30 hours by truck away from main export markets, whilst the New Zealanders are 40 days by boat away from the same markets. So, while scale is different it is not a reason not be able to compete. Europe is an expensive place to live in and farmers can't be expected to take low prices and live in an expensive economy. In Ire there is a real danger of allowing direct payments to become a total distraction at the expense of good technical farming. This distraction does not exist in NZ. There is a need to find a balance between the two, and to avoid the trap of regarding the animals as just heads to be kept to collect direct payments. While it is easy to understand why this is happening, unless these issues are addressed now, there could be a huge price to be paid for this in years to come.

To conclude, there is a 'Freedom to Farm' in NZ that does not exist in Europe at present. We need to be careful here that farmers are not legislated out of existence.

References

AgResearch (2001).

2001.http://www.agresearch.cri.nz/agr/media/press/38_press.htm

Connolly, L. (1997). *Sheep production in New Zealand and Ireland.* Teagasc

Dairy Exporter (Nov. 2001). *Boost to dairy and meat exports* pp 86-87.

Meat New Zealand (2001).

http://www.meatnz.com/wdbctx/corporate/corporate.home

Meat New Zealand (2001). Global sheepmeat - the outlook to 2006

Ministry of Agriculture and Forestry (2001). Situation and outlook for New Zealand agriculture and forestry

Grassland and grazing management for mid-season lamb production

T. Nolan
Teagasc Research Centre, Athenry, Co. Galway

Introduction

In Ireland, grassland occupies about 80% of agricultural land, over 80% of which is permanent pasture. The estimated percentages of grazed herbage, silage and concentrates dry matter (DM) in the annual diet are about 87, 10 and 3 for sheep, 80, 15 and 5 for mixed sheep and cattle, and 61, 31 and 8 for cattle respectively. Efficient grassland use by sheep capable of high productivity at low input cost remains the basis for competitiveness. As this involves the planning and integration of a wide range of soil, plant and animal relationships into a smooth-running predictable whole system, the particular system used tends to be farm specific.

In this paper it is intended to avoid such specificity and to focus on the more important factors of grassland and grazing management for lowland mid-season lamb production, which underpins the achievement of high return on land, labour and capital. It is pitched at a level for efficient grassland use, where high stocking and lambing rate combinations are required, i.e. situations where planning and management are under a more severe test. The system is defined as one in which lambing commences in late February /early March and all lambs are taken to about 42 kg liveweight (18kg carcass) by September.

Grassland type, system selection and potential output levels

Irish land area has been classified according to soil use range as 42% mainly dry mineral lowland, 30% mainly wet mineral lowland, 30% mountain and hill and 7% organic. The mix of these types on a given farm ultimately decides the most appropriate system. The main limitations are wetness, slope and rock outcrop, which limit the proportion of the farm suitable for winter forage conservation. An efficient cattle system requires about 55 and 20% for early and late cut silage respectively, whereas 38% as one late cut will suffice for sheep. This is reflected in about 80% of lowland sheep flocks being farmed in association with a cattle enterprise, about 10% with tillage and 10% as sheep only. The target annual output levels (kg carcass meat ha^{-1}) set by research for sheep and mixed sheep and suckler beef systems are 500 and 366 (206 beef + 160 lamb) (Nolan and McNamara, 1999; 2002).

General planning and management

Grassland management is essentially concerned with achieving a suitable fit between food supply and demand over the whole year, including the correct integration of winter forage conservation. The basis for success is planning and recording. The ewe flock places little demand on roughage quality, except for 1fi months before and 2fi months after lambing. Food budgeting is recommended but it ignores the day-to-day management decisions, as how to deal with wet weather conditions when pastures may be poached. Planning is mainly about the integration of a) *total and seasonal pasture growth*, b) *food requirement relative to ewe and lamb physiological state* and c) *differences in the food requirement of ewes and lambs throughout the year*. In the development of the above mentioned sheep and mixed systems over 8 years (1994 to 1997 for mixed and 1998 to 2001 for sheep), no **date**-related management decisions were made between years for; autumn resting of pasture, first nitrogen application, lambing and calving, putting animals into winter quarters, start of spring grazing or silage closing. This contradicts the oft-stated difficulties surrounding early or late growing spring conditions where the overall stocking rate is much lower than those used in the experiments. While the research systems were run on developed relatively free-draining permanent grassland the rainfall was about 1250 mm per annum.

Recording should be an integral part of planning. Early experience in a collaborative Technology Evaluation and Transfer (TET) programme between Teagasc and sheep farmers emphasised how recording by farmers of lamb growth rate and pasture supply raised issues for discussion as to why differences between farms occurred. This approach should identify interventions required for improvement.

Farm layout and grazing system

Some area sub-division is required when ewes, lambs and rams are separately grazed. Where two different output flocks are used, e.g. meat lamb and breeding of replacements, they should be allocated separate grassland areas. Complete flexibility requires that the number of paddocks is decided by the smallest paddock required, but research has shown that a 4-paddock rotation is adequate for a recommended flock size of about 150 ewes, even at high stocking rate and high lambing rate. For large flocks, subdivision into groups of 150 ewes according to mating date will facilitate subsequent management tasks such as dosing and drafting with consequent improved accuracy and much saving on labour. In the Athenry high output system (consisting of 260 ewes on 16 ha), 8 paddocks were adequate, whereas post-lambing, the flock was divided into two groups of 120 ewes and their 220 lambs and each group was rotationally grazed on 4 paddocks. For the mixed grazing system of 272 ewes and 30 cows, 46 ha was divided into 4 sections so that ewes + lambs could be grazed with cows + calves, steers and heifers and replacement hoggets and heifers grazed together. Thus each system requires a specific plan and management. Paddocks need not be of equal size.

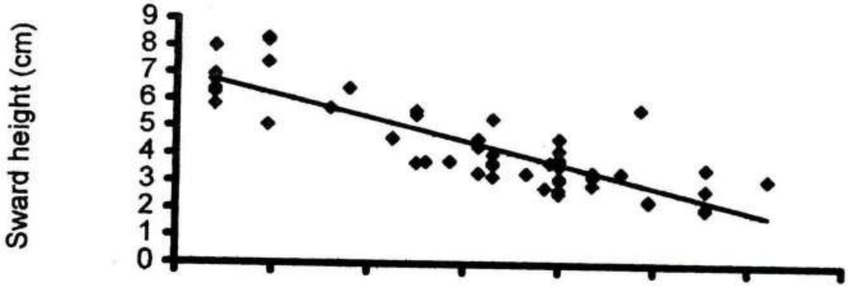
Very often there are a greater number of fields in the farm than that required. Sheep proof fencing should be supplied by grouping fields. Temporary fences to make subdivisions, particularly where it is not desirable to erect permanent fences are available and relatively cheap and easy to erect. Continued use of a small paddock, generally close to the farmstead, for sick animals and for holding animals is considered risky due to possible disease build up, e.g. footrot or parasites. Too much sub-division can also create problems of too high a livestock density on a paddock during grazing. In the Athenry high output sheep system a density of 60 ewes and their 110 lambs/ha worked well. Where, in wet weather a paddock became poached, the sheep were moved on to the next paddock and the rotation speed either adjusted over the following 3 paddocks to maintain overall rotation speed or grazing resumed on the paddock after rainfall had cleaned the soiled pasture. Such periods are interpreted as temporary borrowing from the general pasture supply bank, which can be re-instated soon after. The rotation of the area used for conservation is discussed below.

Grassland management over the year

Autumn / spring management

This is concerned with provision of grazing to flush ewes, resting of half of the area for the following early grazing season and applying fertilisers at the correct times. Gunn *et al.*, (1988) reported higher ovulation rate and therefore higher potential lambing rate in ewes flushed on pasture of 5-6 cm height (2200 kg DM ha^{-1}), compared with 2-3 cm height (650 kg DM ha^{-1}). For the systems under consideration, it is essential that all lambs are drafted by September and that beef heifers are slaughtered by mid-October, when cows, weaned calves and $1^{1}/_{2}$ -year-old steers are housed. This allows ewes to be flushed and prevents loss of condition in cattle and grassland poaching. Ewes can then be grazed on half of the area to about 8 December and 20 December respectively for sheep and mixed systems. Late October resting resulted in 55% more pasture (1426 vs. 918 kg DM ha^{-1}) being available in early spring compared with 8 December resting. Figure 1 shows that these requirements are not achieved on many of the TET farms. Delaying closure from late October to mid-December reduced pasture height in late February by 2 cm and pasture quantity (1 cm height = 200 kg DM ha^{-1}) by about 400 kg DM ha^{-1}, which is close to that recorded in the experiments. These results concur with those by Carton *et al.*, (1988a; 1988b) for re-seeded perennial ryegrass pasture. In the experiments P and K were applied in early November and nitrogen in mid January.

Figure 1. Effect of resting date on spring grass height



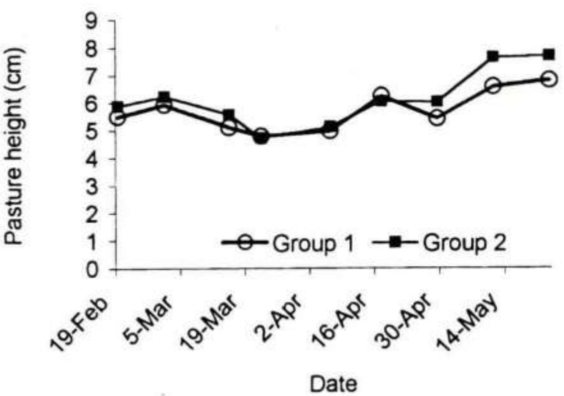
Lambing to weaning

This is a critical time and largely decides whether the system is successful. The target is an average lamb daily liveweight gain of at least 300 g from birth, to be at least 34 kg at weaning (14 weeks), when 35 % (sheep) to 50 % (mixed, where about 15% is drafted before weaning) of lambs will be drafted at 18 kg carcass weight. Ewe milk yield is the main determinant of lamb growth rate to 7 weeks age, when they increasingly rely on grazed herbage, up to a daily intake of 1 kg of organic matter day^{-1} at weaning. In the normal healthy animal the level of grazed nutrient intake governs ewe milk yield and lamb growth rate. This is mainly influenced by the amount and density of herbage on offer, the proportion of green leaf to stem + dead matter present and grazing severity.

The lactating ewe will increase daily DM intake to about 2 1/4 kg at 3 weeks and to 3 1/4 kg at 6 weeks followed by a gradual reduction to about 1 kg at weaning with ewes rearing twin lambs having 11% higher intake (Vulich *et al.*, 1991). At high levels of nutrition, ewe milk supply (kg day^{-1}) increases from about 2.5 at lambing to 3.5 at 3 weeks and then decreases to 2.5 at 6 weeks and to about 1 at 14 weeks. At the same level of nutrition ewes suckling twin lambs generally produce about 40% more milk than those suckling single lambs and this difference is likely to be closer to 60% during the first 3 weeks of lactation. Ewes rearing twins are therefore more efficient. It is well established that suckling ewes loose body weight but within the normal limits encountered, this has no serious consequences where they lamb in good condition as they can mobilise body fat reserves, which they use (with 85% efficiency) to counteract short periods of reduced pasture supply.

Poor ewe nutrition in late pregnancy, results in reduced lamb birth weight and ewe milk supply, which can be identified by little milk in the udder at lambing and protracted production of beistings. Grazed herbage before lambing is best but requires interpretation in a whole system context (Nolan, 1971). Most research evidence indicates that only severe under-nutrition in late pregnancy, even to the extent that lamb birth weight is reduced by 25%, cannot be rectified by good post-lambing nutrition. Such under-nutrition is not recommended. On the other hand, reduced ewe nutrition for even a short period post-lambing reduces twin lamb growth rate, whereas a 70% increased energy intake in the first month of lactation increases lamb growth rate by 24% during that month and by 34% during the following month, with much of the latter being attributed the heavier weight at the start of the second month. Our experience is that there is little difficulty in ensuring adequacy of pasture in late February/early March and it is the pasture re-growth from the first and second grazings, which result in the tightest food supply: demand ratio in mid-March to early April. Thus in the development of the high output sheep system it was essential that the second nitrogen application was brought forward from April to early March. The average pasture heights of all paddocks for the sheep system, where none and 14kg creep / lamb were used, are in Figure 2. In the mixed system, where no creep was used, they were about 1 2/3 cm higher throughout.

Figure 2. Average pasture heights (cm) in group 1 (lamb creep) and group 2 (no creep) areas - 2001



Mixed grazing benefits can be obtained through about 10% higher lamb and beef animal growth rate at constant stocking rate, or by increasing the stocking rate by about 13% (Nolan and Connolly, 1977, 1989). O'Riordan (1990) found that the addition of one ewe and her twin lambs per cow did not affect milk yield or its fat and protein contents, where cows were stocked at 2.5 ha^{-1} and cow milk yield was about 4,500 litres. A 5 kg increase (17 to 22 kg) in lamb carcass weight was obtained at a stocking rate of 10 ha^{-1} over 6 weeks from November 4, on dairy pastures when supplemented with 250 g creep per day (Larue, 1992). Animal movement restrictions may preclude exploitation of the latter despite a lack of evidence of any problems. The benefits are mainly due to complementary grazing, which improve the cattle/dairy pastures, and to lower roundworm burdens in lambs. The lower the proportion of either species in the mix the greater the growth rate benefit to it. The greatest motivation to select a mixed system is that it fits most grassland types in relation to area required for winter forage compared with cattle only as indicated above. Nolan and McNamara (1999) compared the total daily food DM requirement at selected dates for sheep, suckler beef and their mixture at equal LU stocking rates (1.3 sheep + 1.3 cattle ha^{-1}). They showed the effect of mixed grazing complementarily with food requirement, as generally intermediate between sheep and sucklers, and lower at critical early and late season periods (Table 1). The influence of sheep in the mix to reduce food requirement in mid- to late-season, compared with suckler beef is particularly important to ensure adequate pasture supply to meet increasing cattle demand. Since half of the area will be closed for silage from April 9 to early June, food requirement for mixed systems on the grazed half, would be twice the levels stated i.e. closer to 100 kg of DM ha^{-1} day^{-1}, at this time.

Table 1. Pasture dry matter (DM) requirements (kg day^{-1}) at selected dates for sheep, mixed and suckler beef systems at the same annual livestock unit (LU) stocking rate equivalent of1.3 sheep + 1.3 cattle ha^{-1}

Week ending	Athenry mixed system			Separate grazing	
	Sheep	Suckler	Total	Sheep	Suckler
March 9	3	0	3	6	0
April 7	23	16	39	46	32
May 31	24	18	42	48	36
June 14	16	18	34	32	38
August 9	9	22	31	18	44
Sept 7	6	24	30	12	48

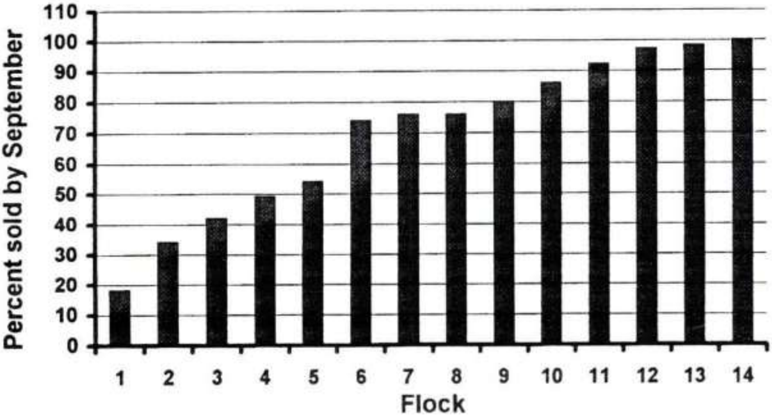
It is clear from the above discussion that the quantity and quality of herbage available post-lambing is the main determinant of lamb and beef animal growth rate. The key aspects are previous autumn management, fertiliser application, rotational grazing pattern and correct integration of nitrogen use and winter forage conservation. In particular, the prevention of the elongation of reproductive stems, through grazing paddocks sufficiently bare to maintain a good balance between new growth and senescence of older material, is a critical requirement to sustain an organic matter digestibility of at least 76%. Measurement or eye-assessment of pasture height is a practical management yardstick. It is convenient to select one paddock and to measure pasture height on all paddocks when it is about to be grazed so that each estimate represents one rotation.

Supplementary concentrate creep

Post-lambing, creep is not considered necessary for ewes which lamb in good body condition. Most documented evidence shows no lamb growth rate response to ewe creep until pasture height falls below 3 cm (Treacher, 1990). Young *et al.*, (1977) recorded no lamb growth rate response to ewe creep during the first 8 weeks of lactation until the stocking rate was over 20 ewes + 40 lambs ha^{-1}. However, when ewe creep contained a higher proportion of protected protein (fish meal) was fed, Penning *et al.*, (1988) obtained a lamb growth rate response, possibly due to the direct effect of higher methionine increasing milk yield (as it does in high yielding cows) (O'Mara *et al.*, 1991). Robinson (1978) found that, in order to obtain improved milk yield through feeding extra protein, increased energy intake is necessary for bacterial activity, only where the ewe is producing below potential. It is concluded that there is no lamb growth rate or economic response to supplementation of lactating ewes, even when rearing twin lambs, except where they lamb in poor condition and subsequent nutrition is poor.

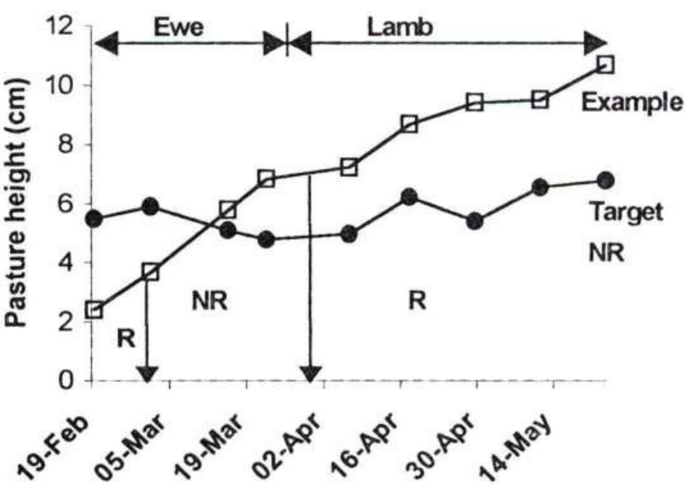
Twin lamb growth rate is decided by genetic ability to grow, ewe milk supply and amount and quality of pasture and / or creep. The aim of offering creep to lambs pre-weaning is to increase income through improved lamb growth rate and / or higher lamb value, and so knowledge of lamb growth rate response and price structure is required. Favourable lamb meat: creep price ratio *per se* does not justify the use of creep where the same lamb growth rate can be obtained without it. Neither can drafting rate be advanced. A response to creep supplementation at grazing is only obtained where the pasture is not supplying an adequate volume and balance of nutrients (Prache *et al.*, 1990). Where some nutrient deficiency, disease and / or parasite problem exists it is best treated directly. Research and commercial farm results have shown that grazed herbage can support the required daily growth rate of 300 g or more in twin lambs from birth to 14 weeks. Response to creep during the period 5 to 14 weeks old varied from zero to 1 kg of liveweight per 5 kg of creep (Treacher, 1990; Grennan, 1999; Nolan and McNamara, 2002). Recent results from farms involved in the TET programme, showed that in 2000 the average annual quantity of creep used was 33 kg ewe^{-1} (range 0 – 90 kg) and 13 kg $lamb^{-1}$ (range 0 –63 kg). For 30 farms in 2001, it was over 20 kg ewe^{-1} on 23 farms (over 40 kg on 9 of these) and over 40 kg $lamb^{-1}$ on 3 farms. There was no relationship between the level of creep used and mating date, pasture supply, number of lambs born / ewe joined, or lamb drafting rate. At a stocking rate of 16 ewes ha^{-1}, lamb performance targets of 4.5, 15, 25 and 35 kg liveweight at birth and at 5, 10 and 14 weeks (weaning) were achieved without supplementary concentrates for ewes or lambs pre-weaning (Nolan and McNamara, 2002). Lambs had access to forward creep grazing, male lambs were not castrated and pasture height was sustained at the target 5 - 7 cm height. Despite the use of creep on the TET farms, only about 25 % had all lambs drafted by September (Figure 3).

Figure 3. Pattern of lamb drafting - TET farms



These results provide strong evidence that income may be seriously eroded by unnecessary use of creep feed, and that there is a great need to improve grassland and grazing management to improve income. Figure 4 reflects the main biological issues involved regarding pasture height and use of creep.

Figure 4. Relationship between pasture height and creep supplementation for example line (R = response: NR = no response)



The 'horizontal line' (•) is the average height of all paddocks for the Athenry sheep system from birth to weaning at 14 weeks old. The inclined line (□) represents a frequently occurring pasture height profile on farms over the same period. The latter is too low (less than 3 cm) at lambing and a lamb growth rate response (R) to ewe creep is indicated. It is then adequate until about 5 weeks into lactation when no response (NR) to ewe creep occurs. Subsequently it is far too high resulting in the development of elongated seed heads and a high proportion of dead matter. In this situation, a response to lamb creep occurs. Thus one may experience a response to creep at both too little and too much pasture availability. Grennan (ongoing) found that the proportion of stem + dead matter in the sward may increase from 20 to 65% as pasture height increases from 5 to over 8 cm. It is concluded that where pasture state is correct, supplementary creep substitutes, rather than supplements pasture in both the ewe and lamb diet.

Protected vegetable protein (By-pass protein)

From normal vegetation, microorganisms synthesise protein from fermentable energy sources in the rumen, and this together with other nitrogen components accounts for about 75 % of all protein in the food. It passes into the intestine where about 85% of it undergoes enzymatic degradation and is absorbed as amino acids. Overall 35 % passes through the animal (ARC, 1995; Hervas *et al.*, 2000). There is evidence since the 1980s that a significant lamb growth rate response could be obtained from creep containing 2 to 5 % of protected protein. In the latter, most of the protein passes unaltered into the intestine where up to 90% of it is absorbed to improve growth rate, mainly due to the amino acids lysine and methionine (Webster and Povey, 1990). Therefore the main issue is the quantity and profile of amino acids entering, or degraded in, the small intestine. For example, the addition of about 50 kg of protected protein t^{-1} to an energy source, as sugar beet pulp or barley, may greatly improve lamb growth rate. Due to the unavailability of fish meal the source of these proteins is restricted to formaldyhyde ('Sopralin') or heat ('Soyapass') treated soya bean meal. Maize distillers grains is a natural source but requires amino acid augmentation, especially with lysine and methionine. Treatment of natural protein sources increases their cost, at present to over €400 t^{-1}. There is still a serious deficit in information, mainly regarding the availability (height x density), quality (supply, balance and availability of nutrients) and intake characteristics of the pastures to which these supplements were added, including the specific influence of clover (Nolan *et al.*, 2001). This is much more difficult to accomplish under grazing compared with indoor more controlled conditions where most of the studies were conducted.

Integration of silage conservation

This is an important component to provide adequate winter forage and also to maintain pasture height at the target level. For the Athenry sheep system the whole farm area was allocated to grazing from lambing to weaning to obtain the maximum lamb growth rate. For the mixed system, ewes and lambs grazed the half of the farm rested from the previous late October, from lambing to 9 April when they were moved to the other half of the area to commence mixed grazing with cattle. The grazed half was then closed to produce adequate winter silage in one early June cut. This suited the higher food demand by the cattle component in late season. The integration of grazing and conservation varied in the planning of the two systems essentially to ensure that the targeted animal performance and winter forage conservation would be achieved. Rotating these areas in alternate years can also help to reduce lamb roundworm burdens.

Post weaning management

In the research systems, weaned ewes were stocked at up to 50 ha^{-1} from late June to mid-September. The loss of about 3 kg liveweight was attributed to reduced gut fill rather than loss of condition. However, periodic identification of some thin ewes and their removal to graze with the lambs for short periods is advisable. Also on some soil types ingestion of soil (silica) may lead to excessive incisor tooth wear (Nolan, 1970). In the research sheep system, lambs less than 36 kg at weaning were offered 250 g creep $head^{1}$ day^{-1} to ensure that they would be finished by September. In mixed grazing this was not necessary as most lambs were over 36 kg at this time and lambs tended to sustain higher growth rate probably because their proportion in the mix was low. Generally in sheep systems it will be necessary to top some paddocks due to lamb preferential grazing pattern.

Conclusions

Efficient grassland use by sheep capable of high productivity at low input cost remains the basis for competitiveness. Planning and recording are essential. Choice of system is mainly determined by grassland type and in particular the proportion of the farm, which is mowable. The quantity and quality of herbage available post-lambing is the main determinant of lamb and beef animal growth rate. A response to pre-weaning creep supplementation at grazing is only obtained where the pasture is not supplying an adequate volume and balance of nutrients. Farm results provide strong evidence that income may be seriously eroded by unnecessary use of creep and that there is a great need to improve grazing management. Further and more in-depth research in this area is indicated to gain greater understanding of the relationships involved under grazing. For a given lamb meat price structure, adjustments to stocking rate, lambing date and grassland management may be required but clearly this is a between rather than within year decision.

References

CAB International (1995). Energy and protein requirements of ruminants. *ISBN 085198 851 2*

Carton, O.T., Brereton, A.J., O'Keefe, W.F. and Keane, G.P. (1988a). Effects of autumn closing date and grazing severity in a rotationally grazed sward during winter and spring. 1. Dry matter production. *Irish Journal of Agricultural Research,* **27**: 141-150

Carton, O.T., Brereton, A.J., O'Keefe, W.F. and Keane, G.P. (1988b). Effects of autumn closing date and grazing severity in a rotationally grazed sward during winter and spring. *Irish Journal of Agricultural Research*, **27**: 151-165

Grennan, E.J. (1999). Lamb growth rate on pasture: effect of grazing management, sward type and supplementation. *End of project report: Sheep Series No. 3*, Teagasc, Athenry, Co. Galway, *ISBN 184170 017 5*

Gunn, R.G., Rhind, F.M., Maxwell, T.J. and Sim, D.A. (1988). The effect of sward height and active immunisation against androstenedione on reproductive performance of ewes of two welsh breeds in different body conditions. *Animal Production*, **46**:417-426.

Larue, D. (1992). Animal production and pasture responses to using dairy pastures to finish store lambs. *Diplome d'agronomie approfondie*, University of Montpellier, France

Nolan, T. (1970). Effect of stocking rate on incisor tooth wear in ewes. *Irish Journal of Agricultural Research*, **9**: 187-196.

Nolan, T. (1971). New systems of fat lamb production are being developed at Creagh. *Farm and Food Research*, **2**: p128.

Nolan, T. and Connolly, J. (1977). Mixed stocking by sheep and steers - a review. *Herbage Abstracts*, **47**: 367-374.

Nolan, T. and Connolly, J. (1989). Mixed versus mono grazing of steers and sheep. *Animal Production*, **48**: 519-533.

Nolan, T. and Grennan, E.J. (1996). Strategies for the extensification of sheep production systems. *47th Meeting of the European Association for Animal Production*. Lillehammer, Norway, August, 1996.

Nolan, T. and McNamara, N. (1999). Sheep and suckler beef production system. *End of project report: Sheep Series No. 5 (Project 4039)*, Teagasc, Athenry, Co. Galway, *ISBN 184170 029 8, pp35.*

Nolan, T., Connolly, J. and Wachendorf, M. (2001). Mixed Grazing and climatic determinants of white clover (*Trifolium repens* L.) content in a permanent pasture. *Annals of Botany*, **88**: 713-724.

Nolan, T. and McNamara, N. (2002). High output mid-season lamb meat system. *End of project report: Sheep Series No. 20 (Project 4455)*, Teagasc, Athenry, Co. Galway, *ISBN 1 84170 309 5*

O'Mara, F., Murphy, J.J. and Rath, M. (1991). The effect of level of feeding and type of concentrate on milk production and nutrient flows of dairy cows. *IGAPA 17th Annual Research Meeting*. p69.

O'Riordan, E.G. (1990). Mixed stocking of dairy cows and sheep. Research Report, Teagasc

Prache, S., Bechet, G. and Theriez, M. (1990). Effects of concentrate supplementation and herbage allowance on the performance of grazing suckling lambs. *Grass and Forage Science*, **45**: 423-429.

Treacher, T.T. (1990). Grazing management and supplementation for the lowland sheep flock. In: *New Developments in Sheep Production*, (Eds. C.F.R. Slade and T.L.J. Lawrence). Occasional Publication No. 14, *British Society of Animal Production* p45-54.

Vulich, S.A., O'Riordan, E.G. and Hanrahan, J.P. (1991). Effect of litter size on herbage intake at pasture by ewes and their progeny. *Animal Production*, **53**: 191-197.

Webster, G.M. and Povey, G.M. (1990). Nutrition of the finishing lamb. In: *New Developments in Sheep Production*, (Eds. C.F.R. Slade and T.L.J. Lawrence). Occasional Publication No. 14, *British Society of Animal Production* p71-82.

Hervas, G., Frutos, E., Mantecon, A.R. and Giraldez, F.J. (2000). Effect of tannic acid on rumen degradation and intestinal digestion of treated soya bean meals in sheep. *Journal of Agricultural Science*, Cambridge, **135**: 305-310.

Robinson, J.J. (1978). In: *European Association for Animal Production*, Publication No 23, p53-65. *ISBN 0906562-00-7.*

Penning, P.D., Orr, R.J. and Treacher, T.T. (1988). Responses of lactating ewes, offered fresh herbage indoors and when grazing, to supplements containing different protein concentrations. *Animal Production*, **46**: 403-415.

Young, N.E., Newton, J.E. and Orr, R.J. (1980). The effect of a cereal supplement during early lactation on the performance and intake of ewes grazing perennial ryegrass at three stocking rates. *Grass and Forage Science*, **35**: 197-202.

Meeting the world's food challenges: people, pets and potables

Alex A. Avery

Hudson Institute, Center for Global Food Issues, PO Box 202, Churchville, VA 24421-0202, USA

Introduction

The short and the sweet of it is that the world is in the midst of the largest increase in global food demand in human history. A likely three-fold increase in food demand will unfold in the next 30-40 years, primarily as a result of economic growth in Asia. That economic growth is driving a greater demand for protein and improved diets throughout the developing world, a demand that is outpacing their agricultural capacity.

In the next 30-40 years, Asia will have half of the world's food and fiber consumers, but less than one third of the world's arable land and less than one fourth of the world's pasture. In short, Asia will be unable to feed and clothe itself. This means export market opportunities will continue to grow substantially for several decades to come.

World food challenges - population

The two factors affecting world food needs and farm product demand are population growth and individual income growth. As the World Bank's website puts it: "No social phenomenon has attracted more attention in the past half century than the 'population explosion' - that surge from about 2.5 billion people in 1950 to more than 6 billion in 1999, making the 20th century one of unprecedented population growth. As the number of people grew, the interval for adding another billion people became shorter and shorter, with the increase from 5 billion to 6 billion occurring in only 12 years."

The world passed the six billion mark in 1999. The world's overall population growth rate is currently about 1.5 percent per year - adding an additional 80-85 million consumers each year to the global population. That's another Mexico added to the world's consumer pool every year. An additional New York City added every month. While an additional 85 million people per year may seem daunting, we are far from heading toward a population disaster.

In fact, recent analysis suggest that the world's peak population will likely be less than nine billion, perhaps as low as eight billion or less. The United Nations Population Division just released a report predicting that three quarters of all nations will have a below replacement fertility by 2050. We're looking at roughly a 50 percent increase over today's global population added over the next 45 years or so.

The slowing population train

The current period marks the first time since the global population reached one billion that adding the next billion people took longer than the previous billion. What this means is that the global population train has its brakes on hard, but it has taken a while for the train to loose momentum.

Fertility rates are always low in affluent countries. This is because in a developed economy children are very expensive. Disposable diapers, Nikeä sneakers, car insurance, college tuition. Women in the workplace mean that childcare, once a "free" commodity, is a major household expense. As a result, women in high-income countries now average only 1.7 children apiece - well below the direct replacement level of 2.1 children per couple (one to replace mum, one to replace dad, and 0.1 to make up for those that die young). In some high-income countries the numbers are frighteningly low. Consider Italy and Germany: with a current average of only 1.2 and 1.33 children per couple respectively, they stand to lose virtually half their population over the next 40 years, not including immigration.

In contrast, larger families make economic sense in poor and relatively undeveloped countries. If you are a poor, subsistence farmer, more children mean more helping hands to harvest the crop, gather firewood, haul water, and do the myriad other chores. In the developing world, children also support their parents in their old age. Thus the incentives are toward large families. The average Third World fertility rate in 1960 was 6.5 children per couple. Today, because of rapid economic growth and rising affluence, the average fertility rate globally is now only 2.7 and falling, meaning that humanity has moved more than 75 percent of the way to a stabilizing fertility rate in only one generation. Moreover, fertility rates are still falling rapidly in virtually all developing countries.

World food needs - affluence

The GATT, now the World Trade Organization (WTO), has clearly shown itself to be the most successful international institution in human experience. It replaced tariff wars with economic growth. World non-farm trade has increased more than sixteen-fold since 1950, and is still rising. As a result of the explosion in world trade, nearly 3 billion people in Asia are now living in market-oriented economies that have been increasing their national economic output by nearly 10 percent per year, compounded, since 1980. This economic growth is headlined by Japan, but also includes Taiwan, South Korea, Thailand, Malaysia, Pakistan, Mauritius, and southern China. India and Indonesia have come a long way as well.

Nearly half of the world's population lives in Asia. And as Asia continues to grow, both economically and in population, we can look to Japan as a model of what to expect from the region as a whole.

Surging demand for better diets

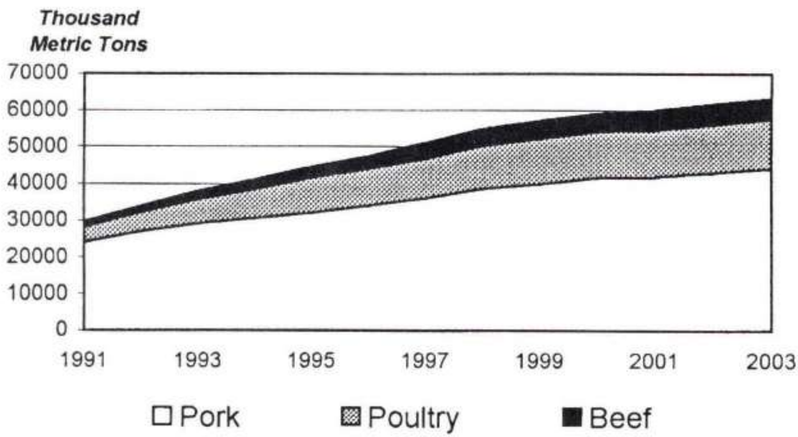
The first thing that poor people do when they get more income is to bid for better diets. First, they want more rice and wheat. Then, they buy more cooking oil. Then, they buy more eggs, milk and, finally, more meat, fruits, and vegetables. These farm products take three to five times as many farming resources to produce as a calorie of cereals – but there is an innate human hunger for them. In Asia the demand for meat has been skyrocketing alongside the rise in personal incomes.

The first Asian tiger was *Japan*, which was also the first of the Asian meat consumers as well. A country that once consumed less than 15 grams per day of animal protein (and felt an urgent need to have fish in the diet) is now nearing 60 grams per day of meat and dairy products. If Japan did not still have such high tariffs on beef imports, the average

Japanese might already eat more than 70 grams of animal protein. This meat consumption pattern is also being emulated in *Taiwan*.

China is the huge Asian food challenge, with 1.25 billion people raising their incomes at a speed never before seen in a large, low-income country (Figure 1). Meat consumption has risen 10 percent annually in the past decade, more than doubling national meat consumption in the 1990s. Most of the expansion to date has been pork, but the demand for both beef and poultry have more than doubled and are still growing.

Figure 1. Chinese Meat Consumption



Moslem countries are also joining in the demand for meat, though they forego pork, which is a favorite meat in many world cultures.

Indonesia, which is both Moslem and Asian, has increased its poultry consumption dramatically. In 1995 the broiler flock rose 25 percent to 600 million birds. The demand for corn in poultry feeds has been rising by 4 million tons per year as the feed industry expanded by 13 percent annually. Indonesia even deregulated soybean imports so that a lack of protein meal wouldn't constrain meat and egg production.

Moslems in *Pakistan* have also been increasing their meat and egg consumption, paid for by cotton and textile exports, which generated economic growth of 5-6 percent annually during the 1990s. Milk consumption has also been rising strongly. To the east, *Bangladesh* is setting its sights on economic growth through export manufacturing. The Bangladeshis already eat many of India's worn-out cows, and will raise the quality and quantity of meat and dairy products in their diets as and when they can afford it.

The question mark over India

A major question over world animal protein consumption has been Hindu *India*. India has long been called a "vegetarian" country, but it is far from that. In recent years, India has doubled its milk consumption to more than 65 million tons per year - and there is little environmental difference between a beef cow and a dairy cow. With a succession of governments dismantling the economic constraints of its creaking socialism, India's consumers are bidding for even more milk. Thanks in part to satellite-fed community TV's, India is no longer content with the "Hindu rate of growth." Economic growth, which had been averaging 4-5 percent annually, has more recently been gaining at 5-7 percent per year. Since 1965, India's birth rate has also dropped dramatically, from 6.2 to 3 births per woman for the 2000-2005 period, contributing significantly to higher personal incomes.

In terms of high-quality protein, India is focused first on dairy products. Consumers seem to be bidding for another 2 million tons of milk per year, and the farmers have only been able to deliver an additional 1 million tons. Prices are high, but feed resources are short. Gaunt cows still graze the roadsides and rummage the city streets in India. One-third of the fodder for 400 million ruminant animals comes from leaves and branches stolen from India's forests!

New clothes, beer and dogs

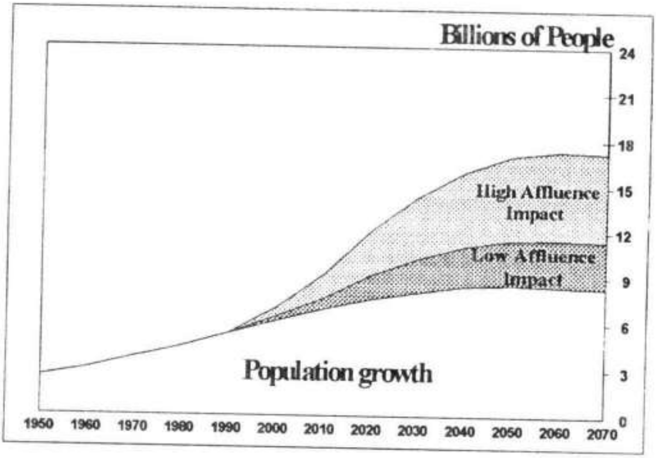
The other reason why the world must triple farm output is that once we have fed 8.5 billion people the way they prefer, other growing farm product appetites will have to be satisfied. Not only will consumers in developing countries eat better, but they will also drink and dress better, too. China's beer consumption has more than tripled in the last decade. How much additional grain will be required, if each of the 730 million Chinese men drink just one extra beer per month? That's 8 billion bottles of beer in a year!

Huge populations of people are moving from societies where everyone owned only two cotton outfits apiece, to a dozen and more - just like any other modern society.

A major challenge exists in relation to pet food. The U.S. has 113 million pet cats and dogs for 270 million people. All over the world, ownership of companion animals and pet food sales rise with incomes. Already, China's one-child policy is stimulating pet ownership. It is reasonable to project that China in 2050 will have more than 500 million cats and dogs, translating into significantly increased demand for pet food, including more meat, fishmeal and protein.

Combining the expected 50% increase in global population with the fact that most of these additional people will live in countries that are increasing individual consumption of high-protein foods - foods that take 3-5 times more farm resources per calorie than cereal calories, it is easy to see how overall farm resource demand will at least double, and will more likely triple over the next 45 years (Figure 2).

Figure 2. Projected food demand of the growing world population, fuelled by rising demand for high-quality foods (meat, dairy products etc.,)



Land - —the scarcest natural resource

The increase in food demand will result in even greater competition between farming and wildlife for land;

- Agriculture already uses 37 percent of the earth's land surface, and any land not already in a city or a farm is wildlife habitat. (UN FAO estimate)
- If the world has 30 million wildlife species (a reasonable biologist's "guesstimate") then 25-27 million of them are probably in the tropical rain forests, with most of the remainder in such critical habitats as wetlands, coral reefs and mountain microclimates. These are places we have not farmed, and should not farm.

Through pesticide use, fertilizers, confinement meat and dairy production and modern food processing, modern high-yield farming has already saved millions of square miles of wildlife habitat from conversion to agricultural use. It is estimated that modern food production systems currently save approximately 15-20 million square miles of 'wilderness' from being ploughed for low-yield food production. That makes it the greatest conservation triumph in modern history!

Thus one key to conserving the natural world in the 21st century will be what the Hudson Institute calls "high-yield conservation." Meeting both the food and forestry challenges of the 21st century, while leaving room for nature, will depend on mankind's ability to continue increasing food and fiber yields per acre of land and per unit of input from plants, animals and trees on our best land, and transporting the products to where the people are demanding it. Success will also depend heavily on how high-tech methodologies such as biotechnology in food, fiber, and forestry are embraced.

Central to this vision is free trade for agricultural products in the global market place. Why? Dairy cows don't perform well in hot, humid tropical climates. Similarly, oranges don't grow well in the cool, damp conditions of the British Isles. Why should India attempt to produce all of its own dairy products inefficiently and at high relative costs when it can import the dairy products it requires and produce more high-value fruit and/or vegetable crops for trade. With free trade we can take advantages in lower production costs and greater resource use efficiencies – benefiting society and the environment.

Hamstringing high-yield conservation

Today the world's most advanced societies are attempting to legislate for low-yield agriculture and block freer trade. All over the developed world, government funding for agricultural research is being cut back, or shifted to low-yield "sustainable" farming. Governments in affluent countries subsidize low-yield organic farming, while regulators respond to public opinion by depriving the world's high-yield farmers of time-tested pesticides and raising the safety hurdles to unjustifiably high levels. In Europe, several governments now have official goals for organic to make up 10-20 percent of farmland by 2010, despite the fact that the demand has leveled off, and something like 60 percent of UK organic milk is sold at a loss as non-organic for lack of demand.

Organic farming is the prescription offered by almost every major so-called environmental group in the world. Greenpeace, Friends of the Earth, the World Wildlife Fund, The Sierra Club, Environmental Defense: all of these groups and scores of others tell the urban public that organic farming is the solution to the worlds food safety and environmental problems. This is a myth.

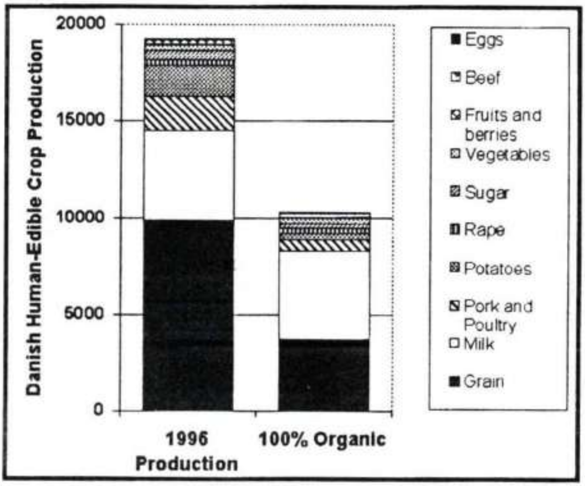
Organic farming cannot possibly meet humanity's food needs without massive increases in the amount of land devoted to manure and green manure production. This land would have to be taken from areas currently devoted to wildlife habitats.

In terms of today's food needs (never mind the needs of the larger and more affluent societies of tomorrow), the requirement for nitrogen fertilizer alone, would necessitate an organic mandate for the massive conversion of land into animal pasture or green manure crop area. The world's farmers currently use roughly 80 million metric tons of synthetic N fertilizer per year, much of this on cropland, but some on pasture land as well. To replace this "synthetic" N fertilizer with animal manure would require another 7-8 billion cattle, according to Dr. Vaclav Smil of the University of Manitoba. Yet the entire world cattle population is estimated today at only 1.2 billion, so this would be a 600% increase in the world's cattle population. Where would we "park" that many additional bovines? At the relatively dense stocking rate of only 2 acres per animal – an inadequate area, in most regions – that works out to 22 million SQUARE MILES of additional pasture needed, or 44% of the planet's entire land area!

Of course, manure isn't the only organic nitrogen source. We could use green-manure crops, that is, legumes plants that fix nitrogen via the bacteria in their roots, but the additional land requirements would still be huge. Work conducted in 1999 by a high-level technical committee appointed by the Danish government to study the consequences of a total conversion of Denmark to organic farming (the Bichel committee), found that if Denmark went totally organic, with no feed imports and no synthetic nitrogen fertilizers, human food production would fall by 47 percent – essentially half! (Figure 3). This drastic cut in food production occurred not because the yields of organic crops were so much lower than those attained from conventional agriculture, but rather from the drastic land use changes necessary to supply an adequate amount of animal manure fertilizer. The committee calculated that Denmark would need a 160 percent increase in grass area in rotation, i.e. cattle pasture and fodder beet crop area would need to increase by 35 percent. This would reduce grain crop area by 30 percent and potato crop area by 70 percent.

Crop yields would also be lower. Organic farming activists claim that organic yields are nearly equal to those of conventional non-organic farmers. However, direct field-to-field yield comparisons show that organic methods produce between 10-40 percent less than non-organic methods when using identical varieties grown side-by-side. Across several studies, organic methods averaged about 15 percent lower in corn yield, 11 percent lower in soybean yield and 30 percent lower in potato yields. [Alternatively an 11 percent reduction in organic soybean yield translates into a 13 percent higher conventional yield. The 30 percent lower organic potato yield translates into a 42 percent higher conventional potato yield!]

Figure 3. Production comparison between conventional agriculture and 100% organic production in Denmark



A recent Swiss study found that over 21-years, organic yields averaged between 10 and 40 percent less (depending on the crop).

Giving the vegetarian solution a chance

Is there a 'vegetarian solution'? Frances Moore Lappe's famous book *'Diet for a Small Planet'* was written 40 years ago. We have run out of time. The world has no larger a proportion of vegetarians today than it had then. A recent reputable survey (by Yankelovich for the '*Vegetarian Times*') found that 4 percent of Americans consider themselves vegetarian - but two-thirds of the vegetarians considered chicken and fish as honorary vegetables. Almost all of them consume dairy products. Less than half of one percent of Americans foregoes any animal calories, i.e. so-called vegans. The percentages are similar in other affluent countries.

It is apparently true that humans could satisfy virtually all of their nutritional needs by eating nuts and tofu instead of meat and dairy products. It is also clear that virtually no society is currently willing to do so, if it can afford meat, milk and eggs. Nor does the environmental movement have plans to spend any of its annual billions in revenue to attempt creating billions of vegans to protect the environment. The environmentalists are content to hope that food shortage will create vegans for them. What we're seeing, instead, is the 'Indonesian solution' - people clearing millions of hectares of tropical forest to grow low-yielding corn and soybeans for chicken feed and poor-quality cattle pasture.

Moreover, another strong worldwide trend in food consumption is towards higher quality. Consumers are moving toward real milk instead of powdered milk, real eggs instead of powdered eggs, and rich ice cream instead of ice milk. They are buying more fresh fruits and vegetables at the expense of canned ones. They are demanding more fresh chilled meat instead of frozen meat. There is little reason to expect that soy burgers or tofu will replace real meat in affluent societies. Thus, the world must prepare itself to supply more meat, milk, eggs and dairy products, more cost-effectively, and with the least possible impact on the environment. This must be done quickly, before undisturbed natural habitats are destroyed. We must move to get more high quality protein from higher yields on the existing farmlands through research and free trade.

Agricultural gas mileage

It is reasonable to ask, 'when environmental activists are demanding that we increase the fuel economy of our automobiles to 20 or 30 kilometers per liter,' why are they advocating that we *reduce* the resource mileage of our agricultural systems? Worse, there is an attempt to block the very technologies that will make more of our farms 'organic-like', via biotechnology. Biotechnology offers a pathway OUT of the external, chemical pesticide route to protecting our crops and livestock. It offers a very cost-effective and biologically based approach to pest protection and yield increases, yet the organic activists and organic farming community is doing everything in its power to stop it. Why - because they're afraid of the loss of a lucrative, high-return niche market for their products?

Consider the opposition to *Bt* crops. *Bt* stands for *Bacillus thuringiensis*, a natural soil bacteria that produces a protein toxic to plant eating caterpillars. It's harmless to birds, fish, mammals, and all non-caterpillar insects. When eaten by humans, *Bt* proteins are digested. Organic farmers have been protecting their crops with aqueous solutions of live *Bt* bacteria for 40+ years.

The biotech version eliminates the aerosol *Bt* sprays – and consequently eliminates the costs of fuel, machinery, and labor of spraying. Instead, the gene for the *Bt* protein is incorporated into the crop plants genome. This not only reduces spraying costs, but also reduces the likelihood of pests developing resistance to *Bt* proteins because the levels of toxin are consistently high. Yet because many more farmers are likely to use *Bt* crop protections, the likelihood of pest resistance may go up and this is the basis for the organic farmer opposition. Organic farmers would like the benefits of *Bt* technology reserved only for themselves. Who gave the organic sector the exclusive rights to *Bt* benefits?

A recent article in the journal *Science*, reports that in 2001, *Bt* cotton in India yielded 80 percent more than non-*Bt* cotton. The benefits are in lower overall costs, less pesticide use, less pesticide risk, higher yields and, thus, resource use efficiency, less land taken from India's wildlife to grow cotton – and all of this in the hands of relatively uneducated, poor farmers in a still-backward country.

Biotechnology benefits

The benefits of biotechnology are now beginning to be realized. Research from Brooms Barn in the UK, and Denmark, is finding significant wildlife benefits in the fields from using biotech herbicide-tolerant crops. More weeds without loss of crop yield, and thus more wildlife that live off of the weeds. The reduction in chemical pesticide sprays from *Bt* crops have been enormous - millions and millions of gallons of pesticides not sprayed, and this is just the beginning:

Raising yields with wild-relative genes: Two researchers from Cornell University reasoned that after a century or more of inbreeding, the genetic base of our crops had significantly narrowed. They also reasoned that the world's gene banks contained a large number of genes from wild relatives of our crop plants. By crossing with selected genes from wild relatives of the tomato family (a crop where yields have been rising by about 1 percent per year), the wild-relative genes produced a 50 percent gain in yields and a 23 percent gain in solids. The same researchers selected two promising genes from wild relatives of the rice plant — a crop where no yield gains had been achieved since the Chinese pioneered hybrids some 15 years ago. Each of the two genes produced a 17 percent gain in the highest-yielding Chinese hybrids; the genes are thought to be complementary, and capable of raising rice yield potential by 20 to 40 percent.

Salt tolerant biotech crops: This has been a long-term agricultural science goal upon which hundreds of scientists have labored via conventional plant breeding methods for decades, with virtually no success. Today, biotechnology has delivered truly salt-tolerant crops, with tomatoes now growing in nearly 40 percent seawater. Uptake however is limited because of politics.

Improved animals with biotech: Heretofore, methods for introducing new genes into livestock had a low efficiency - less than 10 percent. However, in the 24 November 1999 issue of *The Proceeding of the National Academy of Sciences*, researchers reported a new method for producing transgenic animals that approaches 100 percent efficiency. A foreign gene was inserted into the animal's egg pre as opposed to post fertilization. This offers huge potential in producing animals with greater tolerance for pests and diseases, better feed conversion ratios and other practical advantages - the end effect being more efficient farm resource utilization. Think of it as increasing the metaphorical petrol mileage of humanity's agricultural car.

Fighting human malnutrition with genetically modified rice: The Rockefeller Foundation funded research that has overcome two of the world's largest sources of malnutrition with genetically modified rice. Around the world, some 400 million people currently suffer a chronic severe shortage of Vitamin A. About 14 million of these people go blind every year, including about 8 million children. Rockefeller's new 'golden rice' contains beta-carotene, which the human body readily turns into Vitamin A. (The beta-carotene literally turns the rice golden.) The new rice also has three new genes, which overcome the chronic iron deficiency among people in rice cultures; 4 billion people suffer this iron deficiency, women being at an increased risk of birth complications. (The phytate in rice, tied up the iron in their bodies no matter how much iron they consumed; the new rice has phytase to free the iron.) 'Golden rice' will offer improved health to billions of women and children in rice-eating countries who could not have been helped through factory-food additives - at a tiny cost to society and no cost to them.

Saving forests with biotech trees: The world could increase its forest harvest ten-fold if we planted just 5 percent of today's wild forests with high-yield tree plantations. Such plantations are good-but-not-great wildlife habitat because they are not "fully natural," but they could apparently take all of the logging pressures off 95 percent of the natural forests.

Trees have always been difficult to improve through crossbreeding because the time frames are so long. Biotechnology is already helping to provide higher-yielding trees through cloning and tissue culture - which permit us to rapidly copy the fastest-growing, most pest-resistant trees in a species. When we master the tools of biotechnology more fully, we should be able to increase forest growth rates, drought tolerance, pest resistance and other important traits more directly, and even more effectively.

High-yield conservation

There is a need to educate the urban public about the environmental benefits of high-yield modern farming, and why these technologies should be embraced, albeit with care. Increasingly affluent consumers will NOT be satisfied with a vegetarian future.

Agriculture and agricultural researchers must talk about saving natural habitats and wild species with better seeds. We must talk about conquering soil erosion with high yields (so there's less farmland to erode) and conservation tillage (which radically reduces erosion per acre of farmland). We must talk about preventing forest losses to slash-and-burn farming (the cause of destruction for two-thirds of the tropical forests lost). We must point out that where high-yield farming is practiced, the amount of forest is expanding. We must point out that the losses in wildlife habitat overwhelmingly occur where the farmers get low yields.

We must analyze every eco-activist proposal in terms of its land requirements:

- Organic farming for the world would mean clearing at least 5 million square miles of wildlife for clover and other green manure crops.
- Reducing fertilizer usage in the U.S. Corn Belt would mean clearing many additional acres of poorer-quality land in some distant country to make up for the lost yield.
- Blocking free trade in farm products and farm inputs will probably mean clearing tropical forest for food self-sufficiency in Asia.

It should not be solely up to agriculture to prevent such a needless disaster. Agriculture has no history of public affairs campaigns or any real experience in conducting them. However, there is no other entity with the knowledge, the financial requirements and the direct interest to do it.

How can we present the environmental case for high-yield and high-efficiency agriculture if the journalists will not write it and politicians fail to support it? Modern agriculture must take its case directly to the people, through *advertising* and activism.

Recently the Center for Global Food Issues launched an internet eco-campaign with an online petition – 'The Declaration in Support of Protecting Nature With High-Yield Farming and Forestry'. The inaugural signers of the declaration were a co-founder of Greenpeace, two Nobel Peace Prize laureates, the President of the World Conservation Trust, the founder of the Gaia Hypothesis, and two prominent US Senators. More than 800 scientists, agriculturalists, foresters, and conservationists from more than 60 countries have now signed it. The declaration can be read in English, French, Spanish or Portuguese, and is the perfect vehicle for starting careers as an agri-eco warrior.

The declaration can be viewed at www.highyieldconservation.org.

To date, agriculture has failed to rise to the challenge, and the momentum for high-yield conservation is waning. Public investment in high-yield research is low and we are failing to support the farming community. Regulators are continuing to strangle farm productivity at an increasing rate all over the world.

In the long run, of course, farmers and farm researchers will be vindicated even without a public affairs campaign, but that vindication could come too late for the wild habitats and species, and way too late for most of today's high-tech, high-efficiency farmers and agribusinesses.

Fonterra – a blueprint for Ireland?

Harry Bayliss

Director, Fonterra Co-Operative Group

Introduction

This is an important time for the Irish dairy industry with the development of a *strategic plan*. Discussions centred around creating a new 'super co-operative' accounting for some 70% of local milk processing, presents some arguments similar to those advanced in New Zealand (NZ). Arguments for consolidation in processing sites, potential cost savings and increased investment in research and development are all points debated widely in recent times in NZ.

The New Zealand industry

To explain the dairy industry today in NZ requires a brief history lesson.

In 1998, the NZ dairy industry was in turmoil. The government had given notice of deregulation, and the industry had been told to develop a timetable and a process to manage this change. Deregulation was not unexpected, but there were mixed and passionate feelings on the topic. At that point the industry comprised 11 co-operatives exporting 90% of production, and accounting for 20% of NZ exports. In the NZ Dairy Board, there was an effective international marketing organisation with €3.5 billion in sales and an acknowledged competitive advantage in low production costs, extensive dairy trade experience and value-added products.

The industry strategy, developed at that time and endorsed by farmers, set the goal of driving the levels of efficiency within the industry while returning 15% return on Total Gross Assets with a stretch target of 15% year on year revenue growth. A key element of the strategic planning process considered what structures were necessary to take this strategy forward. An industry team evaluated 32 structural options before settling on the preferred '*mega co-op*' structure that is now Fonterra.

Creating the mega co-op was no simple task. It required the largest re-structuring exercise even undertaken in NZ as well as legislative and regulatory consents. While the NZ industry rapidly consolidated (with more than 95% of the industry grouped around two major manufacturing co-ops in 2000), clearing the final hurdle was far from easy. In fact it took a further year before the NZ Dairy Board, the NZ Dairy Group, and Kiwi Cooperative Dairies merged, and Fonterra was created.

Fontarra the company

- A snapshot of Fonterra;
- NZ's largest company;
- Fourth largest dairy company in the world by turnover, accounting for almost 40% of net dairy trade;
- Annual turnover for the year-ended May '02', was almost €6.9 billion;
- Assets of almost €5.9 billion, and 'shareholders' equity of €2.2 billion;

- 13,000 shareholders spread right around NZ, supplying more than 13 billion litres of milk each year;
- 1.8 million tonnes of product manufactured annually, including some of the world's best-known dairy brands;
- 95% of production exported to customers in 140 countries around the world;
- The lowest-cost, dairy producer in the world.

Making the transition from a pair of co-operatives and a marketing arm to a single 'mega co-op' was an extraordinary challenge. Resources included the assets of the contributing co-operatives (including plant and people). The Dairy Board assets included the ingredients marketing network NZMP and the consumer goods company *New Zealand Milk*. The former is a globally significant dairy ingredients company, with a cow-to-customer chain stretching from NZ to a network of offices covering every continent except Antarctica. New Zealand Milk is a consumer and food branded products business, marketing around the world with 96 brands including *Anchor*, *Anlene*, *Anmum*, *Chesdale*, *Soprole* and *Mainland*. New Zealand Milk owns and operates plants globally, which pack bulk dairy and non-dairy products into branded consumer presentations.

Other industry assets included R&D facilities, a biotechnology company (*ViaLactia Biosciences)*, a technology development business, rural retail chains and, an agricultural website called Fencepost.com.

In the first year, the new company had to overcome the extraordinary challenge of creating one company from these businesses, staffed by the right people, with the right resources, systems, processes and culture - all without dropping the ball in terms of collection, production and marketing. While there were instances in that first year when the service was not what it might have been, the overall service delivery was quite an achievement given record peak milk production, record product volumes and record sales in that first year.

Benefits are now starting to emerge from the merger. In the product mix area, for example, €7.0 million was extracted in benefits from increased flexibility. In NZMP an entire link was taken out of the supply chain by moving customer liaison into the manufacturing plants. Work on our supply chain, promises to deliver over €40 million in savings each year. An independent report by Deloitte Touche Tohmatsu confirms that the new company has so far achieved more than €60 million of annualised merger benefits in areas specifically identified as part of the pre-merger analysis, and that Fonterra is well on-track to meet a three-year target of capturing €160 million of total merger benefits.

The Fonterra strategy

One of the great achievements of the first year was the development of '*The Fonterra Strategy*'. With 13,000 farmer shareholders there are **many** opinions as to what direction the company should take. Despite this *The Fonterra Strategy* has been widely accepted as appropriate and achievable. It maps out a path forward for the next five to 10 years.

A key element of this strategy is the defining of cornerstones as the heart of the business. These include activities that sell shareholder's milk and activities that leverage Fonterra's distinctive capabilities. They are also the activities where the predominant source of milk is from supplier shareholders. This is a commitment as a co-operative to process all milk from suppliers.

The cornerstones are what the company is good at. The seven strategic themes of the strategy show where effort is being focused.

The strategic themes

1. To be the lowest cost supplier of commodity dairy products. The NZ dairy industry's low-cost position has always been a core competitive advantage. Fonterra is looking at each step of the value chain to see where improvements can be made. On the farm this means assisting farmers to achieve productivity gains of at least 3%. In the business it means increasing productivity through research, streamlining the supply chain, and constantly looking for ways to reduce manufacturing costs and to serve customers better, for less.
2. The aim is to be the leading price, and inventory manager in the global dairy market. Fonterra has an increasing presence on the global traded market. It stands at around 40% today and is forecast to increase over the next five years. With the increase of supply out of NZ and Australia, coinciding with the reduction in supply from Europe, Fonterra is in a good position to have greater influence over the development and stability of the world market. In effect this means more opportunities to be smarter in the way pricing, inventory, and product mixes are handled, and further opportunities to develop the world market and to secure best product value.
3. Theme three is to become an effective developer of dairy ingredients partnerships in selected markets. An international network and ability to produce dairy products at low cost put Fonterra in an ideal position to take the lead here. The company has developed close relationships with major customers around the world, who are increasingly demanding partnerships with their dairy ingredients suppliers. This is achieved by building broader and deeper relationships with them, providing tailored products and services, e.g. technical know-how and innovative product development.
4. Theme four is to become the leading specialty milk components innovator, and solutions provider. The fast-growing specialty ingredients market has the potential to deliver new value-added earnings for Fonterra. Milk is a truly remarkable product with components that can improve overall health and even fight specific diseases. The opportunities are virtually limitless and can be tapped into by investing more in R&D to create an "innovation engine" within Fonterra that will play a key role in building shareholder value.
5. The intention here is to become the leading consumer nutritional milks marketer. This takes advantage of the growing desire from consumers for products that deliver health and nutrition benefits at different stages in life.
6. Theme six envisages the company pushing further and harder into the rapidly growing global foodservice sector. Consumers today want more convenience. There is a rapidly growing demand from restaurants, hotels, caterers and fast-food outlets for processed dairy ingredients. The brands seen on TV screens etc. are increasingly in demand from restaurants, fast food outlets, hotels, bakeries and so on because these are the businesses consumers are going to more and more for their food. These businesses demand convenience too – shredded cheese rather than blocks, single serve butter pats, butter sheets for bakeries – anything that makes the job faster and easier.

7. Theme seven focuses on developing integrated strategies for the major emerging markets of China, Eastern Europe, India, and the South American economic grouping, of Chile, Brazil and Argentina. These four markets, and what happens in them with regard to supply and demand, will have a major influence on the shape of the overall global dairy market. Therefore it's vital to know about their production capabilities, what is happening with land use, what consumer trends are emerging, and what opportunities exist for ingredients.

While the elements of this strategy may be interesting, the important point to make is that the formation of Fonterra was an integral part of the development of the strategy. Without Fonterra there would not be a united view, or a critical mass to implement the strategy successfully. It has generated tremendous interest and a good deal of excitement because for the first time, there is a shared vision of global industry leadership – there is an agreed strategy that all are behind, from the farm gate to the board and out into the marketplace.

The lessons for Ireland?

What lessons can Ireland (Irl) learn? Does the experience in NZ have any relevance for Ireland?

Be wary of blueprints. The model adopted in NZ was right for the industry, its position in the globally traded market and progress in terms of industry reform. NZ farmers were ready for it, and have worked without subsidies for the past 18 years. In 1984 just one year's advance warning was received that 30 separate production payments and export incentives would be removed. These accounted for 30% of the value of production.

This forced a rapid adjustment to new economic realities – cutting costs, diversifying land use and altering production to fall in line with market signals. It was an abrupt change, accompanied by dire predictions of forced sales of farms, mass bankruptcies and plummeting land prices. In fact, only 1% of farms went out of business and while land prices did drop initially, they rebounded. The overwhelming upside was a significant improvement in efficiency. Since the removal of subsidies, farming productivity in NZ has averaged 3.9% growth year on year. This enforced change was a major factor in the NZ dairy industry achieving its lowest-cost producer status.

At the time of the earliest industry discussions on strategy and consolidation, the NZ dairy industry had already adjusted to life without subsidisation. The changes to market access that arose with the creation of the EU had already been worked through, with major efficiency gains and a very competitive cost structure.

The 'final merger' was a logical conclusion to a lengthy round of industry consolidation. The industry was already globally competitive pre-merger, with a strong focus on moving out of commodity products and into the value-added segment. The merger was based on moving even further forward from this position of competitive and operational strength – especially since NZ commercial interests lay in the opening up of world trade access and the dismantling of market subsidies. It is estimated that NZ dairy exports of €2.4 billion in 2000 attracted duties of €314 million at overseas borders, an average duty rate of 13.1%.

In contrast, Irl continues to enjoy pricing support in terms of EU subsidies, quota systems and subsidies such as headage, premia schemes, fodder schemes and aid for young farmers. In 2001, around 56% of Irish farm incomes came from direct EU payments (Joe Walsh, Minister for Agriculture and Food). This is akin to the NZ dairy industry in 1984, but poles apart from the self-supporting industry that drove through the mega merger some 17 years later.

Had the industry in NZ not undergone significant change already, it is entirely possible that farmers would have rejected the final step to create Fonterra. That final step came after nearly 10 years without subsidies and a great deal of discussion about structural change, starting as far back as 1995. The talk also had to be backed up by some industry leadership. It took the two main co-operatives to undertake a series of strategic mergers to get to a point where the 'mega co-op' concept could be seriously discussed. It's fair to say not all sections of the industry saw the need for change and there were many occasions when the industry's future was debated more with the heart, that the head.

The decisive factor in the end, however, was that the industry came in behind a shared vision. Similar to Irl, NZ saw a changing global market and recognised that major competition was not from the co-ops down the road, but from the shift in retail power occurring globally, and the emergence of non-dairy food products. It took time for everyone in the industry – and that included those negotiating the merger - to recognise that this was a merger focused on international markets. It was not about what was happening at home, or individual companies, but getting the critical mass needed to compete effectively internationally.

To sum up the process in one word, it would be communication. The industry had to invest an extraordinary amount of time, effort and intelligence into educating politicians and regulatory bodies as well as farmers about why consolidation was the best path and what benefits it would deliver for the NZ economy and farmers. So the lesson here is that, change of the magnitude being contemplated in Irl will not be achieved easily, and not only farmers but also all stakeholders must be convinced it is the right step.

The second lesson relates to transparency. One of the major concerns around the merger was farmers' ability to track whether the new 'mega co-op' was creating value for them, or destroying it. Prior to the merger, the NZ Dairy Board did not specifically report long-term performance measures to the industry; its only visible performance measure was payout. The performance of individual co-ops was measured on the margins they added to the Board's payout. The payout and the margins were used as *de facto* performance measures.

The merger required the development of a set of very robust performance measures - the commodity milk price (CMP), and the actual milk return (as discussed earlier). These enabled farmers to compare what Fonterra is paying them against a theoretical CMP independently set. The CMP is the highest theoretical price that an efficient competitor could afford to pay for NZ's milk while making an adequate return on capital.

A further mechanism for assessing performance came with the introduction of a 'Fair Value Share Price' (FVSP). Prior to the merger, shareholders in Fonterra's legacy companies could not assess the value of the investment they had in their cooperative because there was no open market for the shares they held. Transactions between the companies and shareholders were based on nominal share value. Today prior to the start of each season, an independent valuer estimates the FVSP. This takes into account the likely future earnings of Fonterra's separate businesses, corporate overheads, R&D and other operations, as well as the forecasted volume of milk supplied to Fonterra, expected exchange rates, and the number of shares. For 2002, Fonterra's directors set the FVSP at €1.98, which was within the range determined by Standard & Poor's, of €1.88 to €2.19. Clearly, such a mechanism enables farmers to track whether the company is increasing or destroying their wealth.

Governance is another area where Irl could learn lessons. The co-operative model, well established in both countries, has many traditional strengths. Among them is the close contact between directors and shareholder/suppliers and the resultant flow of information between them. As co-operatives have grown beyond geographic groupings, maintaining these links and these information flows becomes increasingly difficult. However, farmers today need more information, not less.

To help solve this problem, Fonterra established a model designed to deliver on these expectations. The 'Shareholders' Council' comprises 45 councillors, spread across the country and in close contact with shareholders. The Council serves as a performance watchdog and as the bridge between the company and shareholders. The Council appoints the valuer who determines the Fair Value Range for Fonterra's shares. It also appoints the Milk Commissioner, whose role is to resolve any shareholders' complaints or disputes with Fonterra. The Council develops and trains shareholders to have a wider understanding of the industry and facilitates targeted training programs for potential future directors. It also has the authority to call a special shareholders' meeting if it has serious concerns with Fonterra's compliance with its cooperative principles or its performance. The council is proving very valuable in ensuring that Fonterra has maintained true co-operative principles.

A further lesson – is the importance of the cow-to-customer chain. In Fonterra, significant benefits have been gained in bringing the NZ Dairy Board into the company. It has enabled Fonterra to overcome the disconnection between supply and manufacturing functions at home, and marketing functions around the world, and allowed for a reduction in supply chain costs by some €41 million a year. Most importantly, it has enabled Fonterra to bring marketing and R&D people together allowing the company to be more responsive to customers and more innovative in meeting their needs.

A final lesson is one still being embraced. The creation of Fonterra, as NZ's largest company, brought with it some external pressures in addition to the pressures of integrating the legacy companies. Where before the industry tended to be reported on in agricultural pages, it now find itself in the financial pages. Consequently, much of the commentary is delivered by people who understand the corporate world, but not the co-operative world, and certainly not the world dairy market. They have yet to come to grips with the new economic principles developed as a discipline for the industry. This is particularly trying given that Fonterra adopted a policy of complete transparency on payout forecasts. In the past, forecasts were made three times a year. Fonterra tracks payout forecasts daily. The policy is to let farmers know if the company believes there is a shift of (€) 5 cents or more, up or down. Rather than applaud such transparency however, the media reports payout forecasts on an emotional 'good news, bad news' basis rather than examining the underlying economic drivers of these forecasts. At the same time, the company's leadership position has evolved an expectation to show leadership, not just in dairying, but also across in a raft of other areas from good corporate citizenship, to research and development and talent development. This intense scrutiny and the higher leadership expectations of Fonterra are not unwelcome, but they do represent an additional burden that had to be carried while bedding the merger in. It is a burden that has been shouldered, and one likely to be encountered in Irl if this route is followed.

Conclusion

Is Fonterra the blueprint for Ireland? Only the industry in Ireland can decide this. The model certainly works in NZ. It has delivered more than €60 million in annualised merger benefits, and potential total merger benefits of €160 million. The industry is unified around a strategy with clear goals to grow shareholder returns. The first year indicated the company's potential. Year two has seen some excellent gains to date in a very difficult market, with commodity prices at 10 year lows and the NZ dollar heading to historical highs. The vision is to 'Lead in Dairy'. The journey began with the merger, but there is a long way to go. However the achievements to date make Fonterra confident that Leadership is an attainable goal. Much has been learnt on the journey and these lessons may well prove useful to the dairy industry in Ireland as it strives to go forward in the years to come.

Genetic selection to maximise dairy herd survivability

D.P. Berry[1], F. Buckley[1], P. Dillon[1], R.D. Evans[1], M. Rath[2] & R.F. Veerkamp[3]
[1]*Moorepark Production Research Centre, Fermoy, Co. Cork*
[2]*University College Dublin, Belfield, Dublin 4*
[3]*ID-Lelystad, P.O. Box 65, 8200 AB Lelystad, The Netherlands*

Introduction

Survivability may be defined as the ability of an animal to remain within a herd over a given time period. Recent trends show a gradual decrease of over 1.0% per year in first lactation animals reappearing as second lactation animals over the years 1993 to 1999 (Irish Cattle Breeding Statistics, 2002). This trend has occurred as a result of management changes and changes in the genetic make-up of the dairy population over this time period. Nevertheless, genetic progress towards improved survivability must be prioritized in order to counteract this phenomenon. Genetic progress is cumulative and permanent, unlike management practices that need to be repeated annually, usually at some repeated expense.

Optimal financial benefits are achieved by maintaining herd calving intervals in the region of 365-370 days and an empty rate of less than 7% (Esslemont *et al.*, 2001). There are losses associated with levels of performance below these standards (Britt, 1985). Annual total culling rate should be kept close to 18% to maximise the benefits of age and genetic improvement (for review see Esslemont *et al.*, 2001).

The ability to breed animals that survive longer in our herds is of economic, welfare and environmental importance. With improved survival, the age structure of the herd is altered towards more mature animals that are expected to have higher yields. Replacement rate/cost is reduced and the overall cost of replacements is spread over a longer time/production horizon. Superior health and fertility reduces veterinary costs and reduces the incidence of involuntary culling thereby increasing the scope for voluntary culling (i.e., more scope to cull lower producing cows). From an environmental point of view, stocking rates may be reduced due to the requirement for a smaller number of replacements and the ability to fill quota with fewer, more mature cows. This has implications for reduced methane emissions. Problems associated with the disposal of specific risk material (SRM) from animals >30 months of age may also be reduced.

The objective of this paper is to illustrate the past, present and future of international breeding programs in improving cow survivability within the herd.

Past international breeding programs

Genetic change is readily achievable through the selection of individuals with performances that differ from the average of the population. Genetic improvement however is more difficult to achieve and requires a favorable genetic change in important traits without deleterious effects on other related traits of importance.

For a long time breeding programs worldwide (with the possible exclusion of the Scandinavian countries) were based solely on milk production without any consideration for other ancillary traits. In Ireland, up until November 2000, each animal received a relative breeding index (RBI) figure, which was a weighted sum of its progeny's capacity to produce milk solids alone. It has now been recognised that selection in dairy cattle solely for high milk production is generally accompanied by reduced fertility (Berry *et al.*, 2003b; Evans *et al.*, 2002) and reduced health (Emanuelson *et al.*, 1988) that may lead to poorer overall survival, especially in seasonal calving herds. It is for this reason that most countries have begun to include traits, other than those associated with milk production, in their selection indexes. Although progress towards increased milk production may be reduced, these selection indexes suggest that better overall economic efficiency will be obtained when functional non-production traits are included in selection objectives.

Current breeding strategies

Economic breeding index

The economic breeding index (EBI) was introduced in Ireland in November 2000. The objective of the EBI is to increase the profitability of the dairy herd. A sire with an EBI of €50 indicates that, on average, offspring from that sire will leave €50 more profit per lactation than offspring from a sire with an EBI of €0. Over the past 10 years the average genetic merit of milk-recorded cows in EBI has increased by €2.5/yr. Herd profitability is governed by a large number of different traits, however, their inclusion within the selection index is limited by the lack of sufficient data. Currently the EBI includes five goal traits:

$$EBI(€) = -0.076PD_{milk}+0.86*PD_{fat}+5.7*PD_{protein}+11.4*PD_{survival}-2.07*PD_{calving\ interval}$$

The EBI is based on predicted differences (PDs) which are defined as the genetic superiority that an animal is likely to pass onto its offspring compared to the average animal within the population (e.g., if a sire with a PD_{milk} of +400 is used across a herd, his progeny are expected to yield on average 400 kg milk more per lactation than progeny of the average sire with a PD_{milk} of 0 kg). All PDs are expressed as deviations from a fixed genetic base, which is currently the average of all cows born in 1995 and milking in 2000 for the three production traits, and test-sires born between 1988 and 1992 for survival and calving interval.

The numerical coefficients of the EBI are called economic values and are defined as the marginal profit per lactation resulting from a genetic change of one unit in that trait (e.g. a 1% improvement in survival will increase profit per lactation by €11.40). The sign of the coefficients indicate the direction that is most favorable (i.e., profitability will be maximized with reduced milk carrier, higher fat and protein yields, positive survival and a negative calving interval). The economic weightings are not directly comparable, due to the different units in which they are expressed. In terms of relative importance, protein yield receives the highest weighting with survival receiving 23% of the relative weighting of protein yield.

Based on the economic value of survival in the EBI, a 0.5% increase in the average genetic merit of heifers entering the national dairy herd (1,250,000 cows), given a 25% replacement rate and an average number of lactations/cow of 3.2, would be worth over €5.5 million annually to the industry. Alternatively, in a 100 cow herd a 0.5% increase in the average genetic merit of incoming heifers for survival would be worth €456/year.

The low heritability for survival (Olori *et al.*, 2002) coupled with the long time required to obtain large amounts of survival data for a sire has led to an increased interest in indicator traits which: 1) can be more easily recorded; 2) can be measured earlier in life; and, 3) possess a co-heritability that is larger than the heritability of the survival trait (i.e. indirect selection for improved survival is more efficient than direct selection for survival). Within the EBI, four linear type traits (angularity, foot angle, udder depth and body condition score) are included within a sub-index to obtain an early, yet reasonably accurate indicator of the potential survival of an animal. These four traits were chosen since they have been found to be strongly related to survival (Table 1). The weighting placed on the indicator trait is reduced as more actual survival data becomes available from the progeny of the sire (Pool *et al.*, 2002).

Table 1. Heritabilities (h^2) and genetic correlations estimated between BCS and the other type traits with calving interval (CIV1, CIV2, CIV3), survival (SUR1, SUR2, SUR3), and milk yield (MILK1, MILK2, MILK3) for the first three lactations.

Trait	h^2	CIV1	CIV2	CIV3	SUR1	SUR2	SUR3	MILK1	MILK2	MILK3
Angularity	0.30	0.38	0.46	0.35	-0.37	-0.19	-0.08	0.59	0.50	0.53
Foot Angle	0.14	0.14	-0.08	0.01	0.28	0.21	0.20	-0.01	0.05	0.04
Udder Depth	0.33	-0.01	-0.11	-0.38	0.13	0.26	0.15	-0.27	-0.22	-0.32
BCS	0.22	-0.18	-0.18	-0.19	0.33	-0.04	-0.21	-0.36	-0.26	-0.32

Source: ICBF; Methodology for the genetic evaluation of calving interval and survival in Ireland

The reliability of each animal's EBI is always presented alongside its EBI figure. The reliability figure describes how certain an animal's estimated PD reflects its true PD. It is a useful guide to the risk of an individual animal's PD changing in the future. The reliability of a trait/breeding goal depends on both the heritability estimates of the trait(s) but also the amount of performance information for either the animal itself and/or the animal's relatives for the trait(s) in question or other correlated traits. Although the models used to predict PDs for animals, scale the individual PDs towards the mean PD to account for the amount of performance information on which they were based, it is not unusual for a sire with low reliability to be highly ranked in EBI only to be subsequently deflated when more information on that animals is accumulated. Similarly, it may also be possible for an animal's EBI to increase with the accumulation of more data.

The golden rule when considering using bulls with low reliabilities (test bulls) is to minimize risks by selecting several bulls. The reliability of the EBI is determined by the average contribution of the production traits (69%) and the average of the fertility traits (31%). Thus the weighted average reliability of each EBI figure is calculated as:

$$\text{Reliability}_{\text{EBI}} = [(\text{Reliability}_{\text{PRODUCTION}}{*}0.69) + (\text{Reliability}_{\text{FERTILITY}}{*}0.31)]$$

Body condition score

In November 2002, body condition score (BCS) was included in the list of linear type traits in Irish sire catalogues. Body condition score is measured at the same time as the other linear type traits and ranges from 1 (extremely thin) to 9 (extremely fat). Results from Moorepark (Berry *et al.*, 2002b) indicated that the genetic correlation between BCS measured by the IHFA (Scale 1-9) and BCS measured by Teagasc staff (Scale of 1-5) was 0.86. This suggests that despite the difference in scale, both BCS measures are genetically the same trait.

Body condition score sire proofs are presented in the same way as all other linear type traits in that they are scaled by their respective standard deviation. Around 68% of animals lie within ±1 on the BCS scale, while 95% of animals lie within ±2. Therefore a PD_{BCS} of 1 implies that the animal will produce progeny that will on average have a BCS which is one standard deviation greater than the average of the population; the current standard deviation of BCS is 0.54 (Brotherstone, *per comm.*), thus the animal's progeny will be 0.54 BCS units (Scale1-9) greater than the average of the population.

Genetic analysis from the Moorepark "Farm Fertility study" showed moderately large heritability estimates for BCS ranging from 0.29 to 0.36 (Berry *et al.*, 2002a). These heritability estimates were larger than those reported for milk yield (0.19 to 0.29) from the same study (Berry *et al.*, 2002a; Evans *et al.*, 2002) and suggest that rapid genetic improvement in BCS is possible with direct selection for BCS.

Many studies (Berry *et al.*, 2003b; Pryce *et al.*, 2001) have reported negative genetic correlations between milk yield and BCS indicating that genetic selection towards increased milk yield alone will result in lower BCS levels. However, because the genetic correlation between BCS and milk production is less than an absolute value of one it is possible, using appropriate economic weightings, to select for higher milk production without any deleterious effects on BCS (Berry *et al.*, 2003b).

There is evidence that an increase in genetic merit for BCS will result in improved genetic merit for fertility (Berry *et al.*, 2003b; Pryce *et al.*, 2001). Berry *et al.*, (2003b) reported favorable genetic correlations between average BCS with calving to first service interval (-0.37), number of services (-0.42), pregnancy rate to first service (0.34) and pregnancy rate 63 days after the start of breeding (0.35).

Alternative breeds/crossbreeding

Currently alternative breeds are unable to be ranked on EBI due to a lack of data and this is likely to remain the situation for the immediate future. Therefore, Irish dairy farmers are unable to rank Holstein-Friesian sires against sires of the many alternative breeds that are available. However, recent experiments from Moorepark (Dillon *et al.*, 2003; Evans *et al.*, 2003) indicate that on average cows from the Montbeliarde breed were economically superior to either the Holstein-Friesian or Normande breeds. Evans *et al.*, (2003) reported superior economic returns from the Montbeliarde breed under three different quota environments. The higher profitability of the Montbeliarde breed was associated with lower replacement costs, higher beef value and higher milk price. Dillon *et al.*, (2003) showed that the proportion of animals that survived to 7 years of age was 20.6%, 49.2% and 55.8% for the Holstein-Friesian, Montbeliarde and Normande, respectively. This difference in survival was due substantially to differences in fertility. Nevertheless, these results reflect an average breed effect and the genetic variation within breed is likely to be just as large as the genetic variation between breeds. Therefore, without being able to rank sires of all breeds on the same scale, using alternative breeds is analogous to "shooting in the dark".

International comparison

International dairy cattle breeding has become an ever-increasing business over the past few decades, fueled mainly by the development of techniques such as artificial insemination and embryo transfer, allowing cross-country transfer of genetics. Much effort has therefore gone into developing procedures to allow breeders in one country to make use of genetic evaluations of animals in another country. This has led to the development of INTERBULL. As well as looking at international converted proofs it is also important to look at the individual countries' breeding programs. Table 2 shows the number of milk-recorded cows in different countries and the proportion of the national population this represents. Ireland is one of the lowest countries with regard to the proportion of the national herd in milk recording. Nevertheless, despite the low proportion of cows milk-recorded, in absolute terms Ireland milk records more cows than most of the Scandinavian countries. Therefore, more emphasis should be placed on maximising the exploitation of available data.

Table 2. Number of milk recorded cows and their proportion of the national dairy herd for several international countries for the year 2000

Country	Number of Recorded cows	Percentage of national population
Denmark	578,000	90.0
Norway	270,028	84.9
Sweden	368,350	82.1
The Netherlands	1,235,501	82.1
Germany	3,669,222	80.4
Estonia	105,958	76.6
Finland	270,575	74.3
Canada	724,456	62.7
France	2,750,700	62.6
Austria	384,320	61.9
Australia	1,028,233	49.0
Japan	522,947	46.5
Greece	74,095	44.1
Spain	499,176	42.2
Belgium	237,662	40.0
Rep. Of Ireland	**391,796**	**31.7**
Northern Ireland	71,336	25.0
South Africa	125,485	22.0
Agrentina	411,555	17.5

Source: www.ICAR.org

The fundamental phenomenon behind genetic gain is that on average individuals in one generation should be genetically superior to their predecessors (i.e. current young test sires should on average be genetically superior to last years test sires). The subsequent dissemination of superior genes within a population can only be achieved through widespread use of young test sires within the national dairy herd. Forty percent of the Norwegian national dairy herd is inseminated with young test sires. This facilitates large progeny groups providing more accurate estimated breeding values (EBVs) for young sires. However, less than 3% of the milk-recorded cows in Ireland are currently inseminated with semen from young test sires. This low usage of test sires is due to the lack of confidence in the current sire-testing program in Ireland. Presently in Ireland we rely heavily on imported semen, thus genetic trends in Ireland tend to follow international trends. These trends are not always compatible with our systems of production. Thus, genetic gain in EBI will only be achievable through selection of sires within our own population (national breeding program) or selection of sires from countries with similar breeding objectives and production systems as Ireland. Continuing to rely on genetics from breeding programs with different objectives to Ireland will seriously hinder genetic gain through the EBI. Farmers must have confidence in the EBI. If confidence in the EBI is increased then the increased use of test sires will follow.

Veerkamp *et al.*, (2000) showed large probabilities of a sire from an Irish national breeding program ranking in the top 10 of foreign sires, ranked on EBI, when the genetic correlation between the average foreign breeding goal and the Irish breeding goal is less than 0.90, and the number of sires tested and the effective number of daughters per sire both exceed 25. This may be achievable at a cost of just over €2.5 million/year, which implies a cost of €5/insemination (assuming 500,000 inseminations). Hence, the cost of an Irish breeding program appears to be considerably less than buying foreign semen.

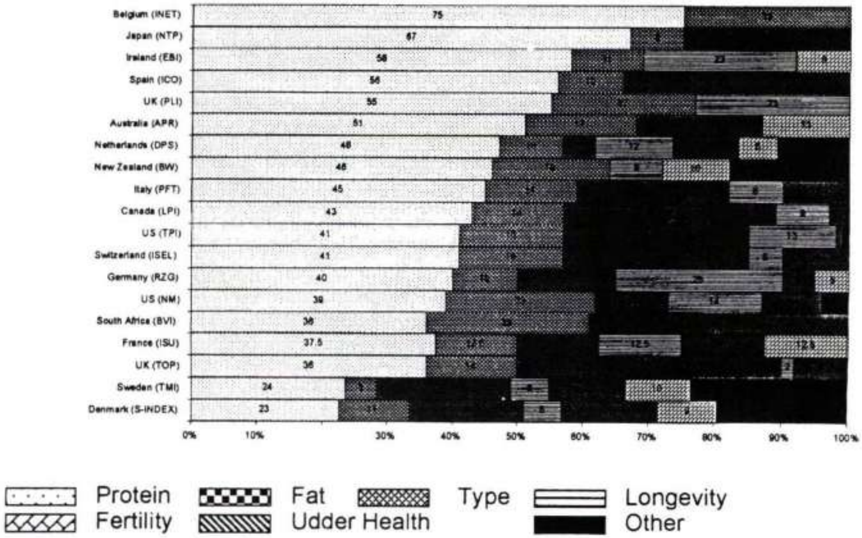
The opportunity also presents itself for a joint testing program with other countries that adopt similar breeding goals to Ireland. This would involve the selection of top sires ranked on EBI (or an index including traits very similar to those currently in the EBI) and the mating of these sires with genetically superior dams within the host country. Semen from the progeny of these matings may subsequently be imported and tested under Irish conditions with the resulting data made available for joint evaluations in the host country. This could be viewed as a method of achieving higher genetic gains at a relatively small increase in cost to the industry.

Increasing the proportion of cows milk recorded will only result in modest increases in national genetic gain, attributed mainly to more accurate sire EBVs as a consequence of larger progeny group sizes. However, milk recording provides an opportunity for the farmer to identify genetically superior cows that should be used to breed replacements. Berry *et al.*, (2003a) has shown that A8 (every 8 weeks) milk recording estimates 305-day yields predicted from A4 (every 4 weeks) milk recording schemes with a small bias (1.9 kg) and with a relatively small standard deviation of the bias (216 kg). Alternate A4 AM-PM recording schemes which are currently operational in Germany, France, Austria, Italy, and Croatia have also shown small bias (2.9 kg to 13.0 kg) and small standard deviation of the bias (214 kg to 227 kg) in estimating 305 day milk yield when compared with 305-day yield predicted from current A4 recording schemes.

Once animals are milk recorded they will enter the IRIS database and will automatically acquire calving interval and survival data. An increase in the number of recorded herds will reduce the number of cows censored for survival (i.e. where cows were sold and entered herds that were not milk recorded).

Figure 1 illustrates the breakdown of individual breeding indexes adopted by several other countries. Over 70% of the indexes shown in Figure 1 have some element of longevity/survival, which indicates its increasing popularity as an economically important trait in breeding programs worldwide. Figure 1 clearly illustrates the substantial opportunity for a joint testing program with another country.

Figure 1. International selection indexes with relative ratios between the different traits



Source: Holstein-Friesian, 2002

Future of breeding

Efficient genetic improvement is dependent on the use of artificial insemination (AI). However, most farmers find the cost of AI prohibitive. An average service charge of €20/service across a 50 cow herd at 1.8 services per cow accumulates to an annual AI bill of €1,800. When added to a labour cost for heat detection and a monetary cost for the inconvenience of the service, the overall cost of AI spirals. This has lead to increased usage of stock bulls.

The use of stock bulls is counter-productive. Reliable breeding values are not available for stock bulls, so it is not possible to determine how good or how bad a stock bull is, especially for traits with low heritabilities (e.g., survival). Similarly, the same stock bull is usually run with the herd as a whole so an individual sire cannot be matched with each individual dam. Change in genetic merit of animals is cumulative and permanent, thus unfavorable trends not only affect the subsequent generation but may also persist for many generations. Most of the traits that animal breeders are interested in are complex quantitative traits, which means that they are controlled by several genes which along with the influence of environmental factors such as nutrition make up the observed phenotype or performance of the animal. So far, most selection has been on the basis of this observable phenotype. As referred to previously, the traditional quantitative approach to selection is based on knowledge of population genetic parameters for the traits of interest, such as heritabilities, genetic variances and genetic correlations. These parameters can be estimated using statistical analyses of phenotypic and pedigree data. Tremendous rates of genetic improvement have been achieved through quantitative approaches, but nevertheless it has limitations. The phenotype can often be an imperfect predictor of an individual animal's breeding value; it may be unobservable in both sexes (e.g., milk production traits) or, may only be observed late in the production cycle (e.g., survival) making efficient genetic progress difficult.

Biotechnology provides an option by selecting for genes directly; DNA can be obtained at any age and from both sexes. The use of molecular information will undoubtedly form an integral part of breeding programs in the future. The two main areas where biotechnology will prove beneficial in breeding programs are in the area of marker-assisted introgression (MAI) and marker assisted selection (MAS). Marker assisted introgression involves the introduction of a favorable allele to a population, while MAS is the use of molecular markers to accelerate selection for a particular trait within a population. Several genes with important effects have been located for important diseases such as BLAD, DUMPS and CVM. However, the identification of individual genes responsible for survival *per se* may prove difficult due to the complex nature of the trait and its low heritability, which would suggest a large number of genes controlling the trait. Nevertheless, opportunities may arise for candidate gene selection, which is essentially genes that have a known function, linked to survival (e.g. a gene coding for improved fertility may be investigated as a marker for survival).

Conclusions

The choice of sires used this year will influence the genetic makeup (survival as well as production potential) of future cows in your herd. Selection may be within or between breeds. However, when selecting within the Holstein-Friesian sires available, farmers must have confidence in the EBI. The EBI ranks Holstein-Friesian sires on overall profitability using economic criteria pertinent to Irish production circumstances. However, attention should be paid to the reliability of the EBI of individual sires. Where possible choose sires with reliabilities greater than 60%. At all times it is advisable to select a number of sires. If fertility and survival are an issue in the herd, then more cognisance can be placed on survival and calving interval traits in the index. Other considerations may include conformation traits, risk of genetic defects (CVM, BLAD) and avoidance of high levels of inbreeding.

References

Berry, D.P., Buckley, F., Dillon, P., Evans, R.D., Rath, M. and Veerkamp, R.F. (2002a). Genetic parameters for level and change of body condition score and body weight in dairy cows. *J. Dairy Science* **85:** 2030-2039.

Berry, D.P., Buckley, F., Dillon, P., Evans, R.D., Rath, M. and Veerkamp, R.F. (2002b). Genetic parameter estimates for body condition score measured by two different sources. Meeting with AI industry & Dairy Herdbooks, Silver Springs Hotel, Cork. 31st July 2002.

Berry, D.P., Buckley, F., Dillon, P., Evans, R.D., Rath, M. and Veerkamp, R.F. (2003b). Genetic relationships among body condition score, body weight, milk yield and fertility in dairy cows. *J. Dairy. Sci.* (In Press).

Berry, D.P., Olori, V.E., Cromie, A.R., Veerkamp, R.F., Rath, M. and Dillon, P. (2003a). Accuracy of predicting yields from alternative milk recording schemes. *Anim. Sci.* (*Submitted*).

Britt, J.H. (1985). Enhanced reproduction and its economical implications. *J. Dairy Sci.* **68:** 1585-1592.

Cromie, A. (2002). Irish cattle breeding statistics. Print Run Limited, Unit 72 Western Parkway Business Park, Ballymount, Dublin 12.

Dillon, P., Snijders, S., Buckley, F., Harris, B., O'Connor, P. and Mee, J.F. (2003). A comparison of different dairy cow breeds on a seasonal grass-based system of milk production. 2. Reproduction and survival. *Livest. Prod. Sci.* (Submitted)

Esslemont, R.J., Kossaibati, M.A. and Allcock, J. (2001). Economics of fertility in dairy cows. Fertility in the high producing dairy cow. Occasional publication No. 26. BSAS. p19.

Emanuelson, U., Danell, B. and Philipsson, J. (1988). Genetic parameters for clinical mastitis, somatic cell counts, and milk production estimated by multiple-trait restricted maximum likelyhood. *J. Dairy Sci.* **71**: 467-476.

Evans, R.D., Buckley, F., Dillon, P. and Veerkamp, R.F. (2002). Genetic parameters for production and fertility in spring-calving Irish dairy cattle. *Irish J. of Ag. and Food Res.* **41**: 43-54.

Evans, R.D., Dillon, P., Shalloo, L., Wallace, M. and Garrick, D.J. (2003). An economic comparison of dual-purpose and Holstein-Friesian breeds in a seasonal grass-based system under different milk production scenarios. *Livest. Prod. Sci.* (Submitted)

Olori, V.E., Meuwissen, T.H.E. and Veerkamp, R.F. (2002). Calving interval and survival breeding values as measure of cow fertility in a pasture-based production system with seasonal calving. *J. Dairy Sci.* **85**: 689-696.

Pool, M.H., Meuwissen, T.H.E., Olori, V.E., Cromie, A.R., Calus, M.P.L. and Veerkamp, R.F. (2002). Breeding for survival and calving interval in Ireland. *7th World Congress on Genetics Applied to Livestock Production*. August 19-23. Montpellier, France. p135-138

Pryce, J.E., Coffey, M.P., Brotherstone, S.H. and Woolliams, J.A. (2002). Genetic relationships between calving interval and body condition score conditional on milk yield. *J. Dairy Sci.* **85**: 1590-1595.

Veerkamp, R.F., Meuwissen, T.H.E., Groen, A.F., van Arendonk, J.A.M., Dillon, P., Cromie, A.R. and Olori, V. (2000). Dairy breeding objective and programs for Ireland. Discussion report following phase 1. Consultancy of the industry. ID-Lelystad report. ID-Lelystad.

Management of young stock for maximum retention in the dairy herd

A.F. Carson[1], L.E.R. Dawson[1] & M.A. McCoy[2]

[1]*Agricultural Research Institute of Northern Ireland, Hillsborough, Co. Down*

[2]*Veterinary Sciences Division, Sormont, Belfast*

Introduction

Heifer rearing has a major effect on the milk production of herds in the UK and Ireland. It is also becoming increasingly clear, through research, that there are important long-term effects of heifer rearing on reproductive performance and the incidence of lameness in the milking herd. Recent survey data from Northern Ireland indicates that infertility and lameness are two of the major reasons for the removal of dairy cows from the herd, accounting for over 30% of the total removals (Mayne *et al.*, 2002). Thus an understanding of the effects of feeding and management of young stock on these factors, which have major effects on the longevity of dairy herd replacements, is important for the dairy industry. Consequently, the objective of this paper is to review the findings of research on the effects of heifer feeding and management on milk production, reproductive performance and lameness. This information is essential to point the way forward for the most appropriate systems for rearing dairy herd replacements for maximum retention and profitability in the dairy herd.

Effect of feeding during the rearing period on milk production and fertility

Prepubertal nutrition

Target growth rates during the various phases of the rearing period should be aimed at maximising mammary development. Udder development is particularly sensitive to nutrition in the period from 3 to 10 months of age. With Friesian-type heifers, high planes of nutrition leading to growth rates above 0.75 kg/d, during the pre-pubertal period have been found to inhibit mammary growth, leading to reductions in milk yield (e.g. Little and Kay, 1979). However research at Hillsborough (Carson *et al.*, 2000) has established that high genetic merit Holstein-Friesian heifers are less sensitive to high planes of nutrition and can be grown at rates of up to 0.95 kg/d during the pre-pubertal period on grass silage and straw-based diets without detrimental effects on milk yield (Table 1). High genetic merit Holstein-Friesian heifers have a larger mature body weight and hence may tolerate higher levels of feeding before the development of milk secretory tissue is permanently inhibited. It is important to note that there are clear differences in the propensity to lay down fat in the udder between strains of Holstein-Friesians. When reared on the same diet, the proportion of milk secretory tissue in the udder was found to be considerably more and the proportion of fat less, in high genetic merit Holstein-Friesian heifers compared with medium genetic merit Holstein-Friesian heifers and New Zealand heifers (Table 2). Thus there remains a need to ensure that growth rates of lower mature weight dairy herd replacements are controlled during the pre-pubertal period.

Table 1. The effects of rearing regime from 3 to 10 months of age on subsequent milk production in high genetic merit Holstein-Friesians (Carson *et al.*, 2000)

	Treatment		
	Low plane Silage	High plane Silage	Highplane Straw
3 – 10 months of age			
Concentrate feed level (kg/d)	1.0	2.5	3.7
Liveweight gain (kg/d)	0.70	0.95	0.93
Live weight at 10 months (kg)	244	291	288
At calving			
Live weight (kg)	549	588	596
Withers height (cm)	137	139	141
First lactation (305-days)			
Milk yield (kg)	6242	6594	6767
Milk fat (%)	4.14	4.22	3.99
Milk protein (%)	3.28	3.36	3.24

Table 2. Udder composition at 15-months of age in high genetic merit (HGM) Holstein-Friesian, medium genetic merit (MGM) Holstein-Friesian and New Zealand (NZ) heifers (Carson *et al.*, 2002a)

	HGM	MGM	NZ
Weight of udder (g)	2021	2398	1827
Udder composition (%)			
Parenchyma	45.7	34.1	26.8
Fat	38.5	45.4	56.1

Protein nutrition has been raised as a potential key factor influencing pre-pubertal udder development. However, whilst some studies have found that increasing the protein content of the diet has reduced pre-pubertal mammary fat deposition, no studies have observed any subsequent significant increase in milk production (Dobos *et al.*, 2000). Diets should be designed to ensure protein supply is adequate during the various phases of rearing to ensure optimal growth. It is important to note that oversupplying protein as well as being detrimental to the environment, through increasing nitrogen excretion in the faeces and urine, has been found to increase fat deposition in growing beef heifers (Steen and Robson, 1995). Overall protein contents of the diets fed to heifers at Hillsborough are given in Table 3.

Table 3. Dietary protein contents of diets fed during the rearing period

Live weight range (kg)	Protein content (% of total ration DM)
Birth – 100	18
100 – 300	17
300 – 400	16
400 – first calving	14

Effects of weight at first calving and diet type

With Friesian animals a target pre-calving live weight of 520 kg at 24 months of age was established for heifer rearing systems based on research carried out during the 1960 to 1970's. At this weight, milk production in Friesian heifers was not curtailed due to inadequate body size (e.g. Little and Harrison, 1981). However, high genetic merit Holstein-Friesian animals, which are widespread in the UK and Ireland, have an increased live weight and frame size at maturity compared to their medium merit contemporaries (Mayne and Gordon, 1995). An impetus for heavier weights at calving has been initiated, based on survey data from the United States which indicated that optimal first lactation milk yields were obtained when Holstein replacement heifers weighed 590 to 635 kg at calving (Keown and Everett, 1986). To develop appropriate targets, the impact of adopting heavier weights at calving in Northern Ireland dairy systems has been investigated at Hillsborough.

Increasing the plane of nutrition during the second year of life, to adopt heavier weights at calving, (620 compared with 565 kg) was found to have no significant effect on milk production (Carson *et al.*, 2000) (Table 4). Dry matter intake in early lactation in the heifers calving at 565 kg was higher compared with animals calving down at 620 kg and this appeared to offset the milk production associated with the increased body mobilisation in the heavier animals.

Table 4. The effect of adopting heavier weights at calving through increased plane of nutrition from 14 to 24 months of age (Carson *et al.*, 2000)

	Plane of nutrition	
	Low	**High**
Pre-calving		
Live weight (kg)	568	620
Condition score	3.1	3.5
Withers height (cm)	137	138
First lactation (305-days)		
Milk production (l)	6767	6931
Fat %	4.01	4.01
Protein %	3.39	3.30
Fat plus protein (kg)	500	507

This balance may change in commercial production systems where dry matter intake may be limited due to factors such as competition from larger herd mates and variable forage quality. In addition, increases in body condition associated with heavier weights at calving may be less if increases in growth rate are phased in strategically over the whole two-year rearing period A large-scale study was undertaken to investigate the effect of weight at first calving and diet type on body size, reproductive performance and milk output in commercial milk production systems. In this programme 11 milk producers supplied heifers for rearing under 4 rearing systems (Carson *et al.*, 2002b) (Table 5). Heifers were returned to the farms of origin one-month before calving where subsequent performance was recorded.

Table 5. Effects of rearing treatment on body size milk yield and composition during the first and second lactation

	Rearing regime			
Live weight at 24 months →	540 kg	620 kg	620 kg	620 kg
Forage during winter →	Silage	Silage	Straw	Straw
Forage during summer →	Grass	Grass	Grass	Straw/Grass
Body size pre-calving				
Condition score	2.8	3.6	3.4	3.4
Withers height (cm)	134	137	139	139
First lactation				
Milk yield (kg)	7222	8020	7956	7901
Fat (%)	3.81	3.70	3.70	3.77
Protein (%)	3.27	3.13	3.17	3.26
Fat + protein yield (kg)	511	544	544	554
Milk value (£)	1296	1387	1387	1410
Second lactation				
Milk yield (kg)	8909	9319	8831	8777
Fat (%)	3.91	3.63	3.76	3.86
Protein (%)	3.35	3.26	3.26	3.24
Fat + protein yield (kg)	645	638	610	623
Milk value (£)	1638	1639	1574	1575
Economics of rearing system				
Value of milk over 2 Lactations (£)	2934	3026	2961	2985
Fertility cost (£)	-160	-302	-400	-395
Feed cost of rearing (£)	-345	-474	-477	-502
Milk value less feed & Fertility costs (£)	2429	2250	2084	2088

Averaged across 11 farms, first lactation milk yield was 11% greater in animals reared to calve down at 620 kg compared with those reared to calve at 540 kg (Carson *et al.*, 2002 b) (Table 5). Fat plus protein yield was increased by 0.41 kg per kg additional live weight above 540 kg (approximately 80% of mature weight). Milk production during the second and third lactations was not affected by rearing regime. By the end of the first lactation, although there remained slight differences in skeletal size as indicated by body length, heifers reared to 540 or 620 kg at first calving were of similar live weight.

Weight changes during the first lactation indicate that the higher milk yield produced in the animals reared to calve at 620 kg was due to increased mobilisation of body reserves and not supported by increased intake. In fact, dry matter intakes in early lactation have been found to be lower in animals reared to heavier weights at first calving (Woods *et al.*, 2003). Data from large-scale dairy cow studies suggest that condition score at calving/and or greater rate of body condition score loss during early lactation are correlated with poorer fertility (Mayne *et al.*, 2002). Likewise, in the present study heifers reared to calve at 620 kg, which lost more weight in early lactation had a longer interval to first recorded oestrus than those reared to calve at 540 kg (Table 6). Heifers reared to calve at 620 kg also tended to have a longer calving interval, which as well as having an effect on management for those herds striving to maintain a seasonal calving pattern, has a detrimental effect on milk production over the lifetime of the animal (Esslemont *et al.*, 2001). Interestingly, the trend for heifers reared to calve at 540 kg to have a shorter calving interval was repeated in the second and third lactation. This cannot be explained in terms of differences in live weight or condition score at the second calving and may indicate that nutrition during the rearing period has permanent effects on the hormonal pathways affecting reproductive performance.

Table 6. The effect of rearing regime on reproductive performance during the first lactation (Carson *et al.*, 2002b)

	Rearing regime			
Live weight at 24 months →	**540 kg**	**620 kg**	**620 kg**	**620 kg**
Forage during winter →	**Silage**	**Silage**	**Straw**	**Straw**
Forage during summer →	**Grass**	**Grass**	**Grass**	**Straw/Grass**
Calving to1st recorded heat (d)	70	102	108	87
Calving to 1st service (d)	86	109	120	115
Proportion pregnant	0.94	0.98	0.91	0.88
Services/conception	1.7	1.8	1.8	2.4
Calving interval (d)	394	426	435	458

Diet type during the rearing period had no significant effect on subsequent milk production even though significant differences in mammary development were detected in animals at 18-months of age (Carson *et al.*, 2003). This may indicate that animals reared on silage-based diets during the winter, which had reduced milk secretory tissue at 18 months of age compared with animals on straw-based diets, exhibit compensatory milk secretory tissue development during the subsequent summer grazing period. Likewise, improvements in udder development, which were gained through pasture grazing during the first summer compared with feeding indoors on straw-based diets, were not correlated with any increase in performance.

Over the 34-month period post-calving, the cumulative milk yield produced by the heifers reared to calve at 540 kg has been similar to the animals reared to calve at 620 kg (20 195 versus 19 856 litres). Thus the higher first lactation milk yield of the heifers reared to 620 kg has been negated by the shorter calving interval in the animals reared to calve at 540 kg, combined with the fact that rearing effects have not extended into subsequent lactations. In conjunction with the higher rearing costs associated with the larger heifers, these results indicate that rearing heifers to calve at 620 kg is uneconomic (Table 5). Furthermore, from a management point of view it is easier to rear heifers to a moderate live weight (540 kg) for calving at 24 months of age which, as well as being the most economic, is fundamental to maintaining a seasonal calving pattern.

Effect of feeding during the rearing period on lameness

Lameness is a major welfare and economic issue for the dairy industry in Northern Ireland. Sub-clinical laminitis, characterised by haemorrhages in the sole of the claw, is believed to be a major pre-disposing cause of lesions such as sole ulcers and white line lesions which are an important cause of lameness (Offer *et al.*, 2001). Nutrition during the rearing period has an important effect on claw development and can predispose heifers to these types of foot problems.

Forage type fed during the rearing period has been highlighted as an important potential factor in claw development. Workers in Scotland (Offer *et al.*, 2001) reported that feeding low dry matter grass silage (19% DM) for 3-months after service, as compared with grass hay, was associated with a greater prevalence of poor locomotion and haemorrhages in the sole in first lactation heifers. Both claw horn lesions and lameness are recurrent. Heifers lame in their first lactation are 2 to 3 times more likely to be lame in their second lactation (Ward & French, 1997). In addition, heifers fed on low, compared with a high dry matter silage during lactation have been found to have a higher incidence of claw horn lesions (Webster, 2002). It has been suggested that wet faeces on the floor contributes to the chemical erosion of both the sole and heel therefore increasing the force of the impact between the sole and the pedal bone giving rise to claw horn lesions. In studies at Hillsborough, forage type during the rearing period had no significant effect on lesions in the sole area, however heel erosion scores during the rearing period were significantly lower in heifers reared on the straw-based diets during the winter periods. Whilst the effects of forage type on claw development were smaller in the study at Hillsborough compared with work from Scotland, both studies indicate advantages of feeding heifers high dry matter forages during the rearing period when housing in cubicle accommodation.

Level of feeding during the rearing period has also been shown to affect the incidence of claw abnormalities (Carson *et al.*, 2003). When assessed at 18-months of age (end of the second winter period) increasing concentrate feed levels to adopt heavier weights at first calving on silage-based diets had no significant effects on lesions of the sole, but led to large increases in heel erosion. Increasing the concentrate portion of grass silage-based diets is likely to cause reductions in rumen pH, which Greenough and Vermunt (1991) suggested may activate vasoactive mechanisms and substances which can cause degenerative changes in heel horn formation. It is also possible that the observed increases in heel erosion were simply due to the fact that heifers on the higher plane of nutrition were heavier and consequently had increased pressure on the claws, which has also been linked to increased heel erosion (Baggott and Russell, 1988).

Effect of dairy heifer management on milk production and fertility

Parlour training

There is increasing interest on the effects of management during the rearing period on the subsequent performance of dairy herd replacements. At Hillsborough, research in this area is now examining the management of dairy herd replacements during the transition period (3-weeks before and after calving). The work so far has examined the effect of introducing heifers to the milking parlour prior to calving on subsequent milk production, health and fertility as well as stress responses and behaviour in parlour.

Results to date indicate that introducing heifers to the milking parlour before they calve may enhance their milk production due to reduced stress (Table 7). The study included both Holstein-Friesian and Norwegian dairy cattle and with both breeds the effect of transition management was found to be very important. Provisional behavioural observations indicate that preconditioning heifers to the milking parlour before calving reduces the number of kicks and general restlessness of heifers during the milking routine post-calving. Heifers trained through the milking parlour prior to calving produced 1.5 litres extra milk per day during the first 100 days of lactation compared to those which were not accustomed to the parlour pre-calving. However, the increased milk yields were accompanied by increased live weight and body condition losses, which may have been responsible for the poorer reproductive performance of these heifers during the first lactation. The combined effects of longer intervals from calving to first service and a tendency for lower conception rates in the heifers introduced to the milking parlour pre-calving, meant that the interval from calving to conception was 19 days longer for these heifers (102 versus 83 days). Thus, overall the detrimental effects on reproductive performance negated the beneficial effects of in parlour training on milk yield. Research in heifer management needs to develop further to identify means of increasing dry matter intake in early lactation so that production responses are not accompanied by reductions in reproductive performance.

Table 7. Milk production of Holstein-Friesian and Norwegian dairy herd replacements during the first 100 days of lactation, following either pre-conditioning to the milking parlour (preconditioned) or no preconditioning (control) (Wicks *et al.*, 2003)

	Holstein Friesian	Norwegian	Control	Pre-conditioned
Milk Production				
Milk Yield (kg/d)	27.4	25.0	25.4	26.9
Fat (%)	4.07	3.79	3.99	3.87
Protein (%)	3.32	3.29	3.30	3.31
Total Fat + protein yield (kg)	50.2	50.3	50.3	50.2
Somatic cell count ('000)	134	114	156	95
Reproductive performance				
Interval from calving to:				
1st Progesterone rise (d)	38.3	29.7	36.2	31.8
1st oestrus detection (d)	59.9	43.1	49.2	53.8
1st service (d)	80.5	77.1	76.0	81.5
Conception (d)	96.1	89.1	83.0	102.2
Services/Conception	1.61	1.57	1.29	1.89

Managing heifers as a separate group

The social hierarchy that exists in a herd of cows means that the youngest and newest members of the group normally rank lowest. The individual cow's rank in the herd is thought to play an important role in determining her feed intake (Krohn and Konggaard, 1979). Thus it has been suggested that regrouping cows more uniformly with less extremes in social strength will improve the conditions for the weaker individuals of the herd.

Work carried out 20 to 30 years ago reported significant benefits from housing heifers separately from mature cows. On self-feed silage systems, Drew and Altman (1982) reported that heifers housed separately from mature cows produced 3.5 kg/day (+18%) more milk. With easy-feed systems, a Danish study (Krohn and Konggaard, 1979) indicated smaller but still significant effects (5 to 10%) of housing first lactation heifers separately from mature cows (+0.8 to 1.6 litres per day). Krohn and Konggaard (1979) reported that the milk production responses observed in their study were the result of heifers grouped separately, spending 10 to 30 minutes longer per day eating compared with heifers grouped with older cows. It was suggested that this difference in intake was due to the fact that first lactation heifers mixed with mature cows, follow the same eating pattern of the cows (social facilitation). Since mature cows eat faster than first lactation heifers, the eating time for heifers mixed with cows is reduced compared to the situation when heifers are housed as a single group. With complete diets the effects of housing heifers separately have been found to be less (Drew, 1988) or totally absent (Lawson, 1999), perhaps as a result of total time feeding being less of a limitation on total dry matter intake.

Housing first lactation animals separate from mature cows undoubtedly complicates feeding and management. Research information in this area is limited, particularly in relation to effects on reproductive performance, incidence of mastitis and lameness. Nonetheless, in some housing systems the separation of heifers from mature cows during the first lactation may be a practical and cost-effective practice. However, to develop improved management systems which can be more easily adopted there is an urgent need for an increased understanding on factors influencing the behaviour of heifers in the milking herd. There may be easier means of improving the feeding behaviour of heifers in the milking herd. For example, the timing of the heifer's introduction into the herd may have important long-term effects. There are some indications that delaying the introduction of heifers into the milking herd from 1 until 5 days after calving reduces stress (Lawson, 1999). Also introducing heifers after the evening milking rather than the morning milking is preferred as at this time cows are less socially active and this may have long-term benefits. Research in these areas is underway at Hillsborough with the aim of developing transition management systems to minimise the physiological and behavioural stress of heifers, thereby maximising their longevity.

Housing in early lactation

There is clear evidence that claw horn lesions in first lactation heifers are greater when animals are housed in cubicle accommodation compared with straw yards (Livesey *et al.*, 1998). Recent research has found that housing heifers for 4 to 8 weeks after calving on straw before moving to cubicle accommodation significantly reduced the severity of lesions (Webster, 2002). Even this limited period of housing heifers on straw would have a significant impact on the costs of production for herds in Ireland and it is also important to consider that there is an increased risk of environmental mastitis with animals on straw bedded courts (Berry, 1998). With cubicle accommodation emphasis must be placed on making cubicles as comfortable as possible to maximise lying time. In addition, getting heifers to grass through the use of extended grazing in the late autumn and early spring is likely to reduce the challenge to the feet and thus lower the prevalence of feet problems.

Summary

Research has provided sound information on which to base heifer rearing systems. The target body size for high genetic merit Holstein-Friesian heifers calving at two years of age should be 540 to 560 kg, at a body condition score of 2.75 to 3.0. Appropriate live weights for the various phases of rearing are detailed in Table 8. With cubicle accommodation, feeding low dry matter forages during the rearing period (and first lactation) increases the risk and incidence of lameness. Training heifers to the parlour increases milk yield, but this increase in production appears to be the result of increased body tissue mobilisation reducing reproductive performance. Housing heifers separately from mature cows during the first lactation may have benefits but complicates management. Research is required to develop management systems to reduce the stress during introduction of heifers to the milking herd. Work in this important area is underway at Hillsborough.

Table 8. Target live weights during the rearing period for medium and high genetic merit heifers

	Target live weight (kg)	
	Medium merit	**High merit**
Birth	38	41
6 weeks	60	65
12 weeks	90	95
6 months	150	160
14 months	315	330
23 months	500	530
24 months	520	550

Acknowledgements

The authors would like to thank the staff of the sheep and dairy heifer rearing unit. The authors are indebted to the following dairy producers, without whom this work would not have been possible – Mr E. Black, Mr J. Davidson, Mr P. Drayne, Mr W. Gordon, Mr J. Irwin, Mr D. Johnston, Mr J. Harris (Dunleath Estates), Mr M. McCollum, Messrs W. and A. McCollum, Messrs S. and K. Montgomery, Messrs W. and A. McConnell, Messrs D. and K. Telford. Thanks are also due to Mr A. Gordon for assistance with the statistical analyses. This programme is funded by DARDNI and AgriSearch.

References

Baggot, D.G and Russell, A.M. (1988). Lameness in dairy cattle. *British Veterinary Journal* **137:** 113-132.

Berry, E.A. (1988). Mastitis evidence on straw yards and cubicles. *Veterinary Record* **141:** 517-518.

Carson, A.F., Wylie, A.R.G., McEvoy, J.D.G., McCoy, M. and Dawson, L.E.R. (2000). Effects of plane of nutrition and diet type on mammogenic hormone concentrations, growth and milk production in high genetic merit dairy herd replacements. *Animal Science* **70:** 349-362.

Carson, A.F., Dawson, L.E.R., McCoy, M.A. and McEvoy, J.D.G. (2002a). Research points the way forward for heifer rearing. In: *Recent Research in Dairying,* Proceedings of a seminar held at the Agricultural Research Institute of Northern Ireland, March 2002. pp. 1-17.

Carson, A.F., Dawson, L.E.R., McCoy, M.A. and Gordon, F.J. (2002b). The effects of rearing regime on body size, milk production and reproductive performance in high genetic merit Holstein-Friesian dairy herd replacements. *Animal Science* **74:** 553-565.

Carson, A.F., Dawson, L.E.R., Wylie, A.R.G. and Gordon, F.J. (2003). The effects of rearing regime on the development of the mammary gland and claw abnormalities in high genetic merit Holstein-Friesian dairy herd replacements. *Animal Science* (Submitted).

Dobos, R.C., Nandra, K.S., Riley, K., Fulkerson, W.J., Lean, I.J. and Kellaway, R.C. (2000). The effect of dietary protein level during the pre-pubertal period of growth on mammary gland development and subsequent milk production in Friesian heifers. *Livestock Production Science* **63:** 235-243.

Drew, S.B. and Altman, J.F.B (1982). The effects of weight at first insemination on the subsequent performance of Friesian dairy heifers. *Animal Science* **34:** 371 (Abstract).

Drew, S.B. (1988). The influence of management factors during rearing on the subsequent performance of Friesian heifers. *British Cattle Breeders Digest* **43:** 41-48.

Esslemont, R.J., Kossaibati, M.A., and Allcock, J. (2001). Economics of fertility in dairy cows. *Occasional Publication of the British Society of Animal Science* No. 26: 19-29.

Greenough, P.R. and Vermunt, J.J (1991). Evaluation of subclinical laminitis in a dairy herd and observations on associated nutritional and management factors. *Veterinary Record* **128:** 11-15.

Keown, J.F. and Everett, R.W. (1986). Effect of days carried calf, days dry, and weight of first calf heifers on yield. *Journal of Dairy Science* **69:** 1891-1896.

Krohn, C.G. and Konggaard, S.P. (1979). Effects of isolating first lactation cows from older cows. *Livestock Production Science* **6:** 137-146.

Logue, D.N and Offer, J.E. (2001). Guest editorial: The effect of forage type on foot health in dairy heifers. *The Veterinary Journal* **162:** 7-8.

Lawson, R. (1999). To develop improved strategies for the management of heifers after calving. Milk Development Council Report.

Little, W. and Harrison, R.D. (1981). Effects of different rates of liveweight gain during rearing on the performance of Friesian heifers in their first lactation. *Animal Production* **32:** 362 (abstract)

Little, W. and Kay, R.M. (1979). The effects of rapid rearing and early calving on the subsequent performance of dairy heifers. *Animal Production* **29:** 134-142.

Livesey, C.T., Harrington, T., Johnston, A.M., May, S.A. and Metcalf, J.A. (1998). The effect of diet and housing on the development of sole haemorrhages, white line haemorrhages and heel erosions in Holstein heifers. *Animal Science* **67:** 9-16.

Mayne, C.S. and Gordon, F.J. (1995). Implications of genotype X nutrition interactions for efficiency of milk production systems. In *Breeding and feeding the high genetic dairy cow* (ed. T.L.J. Lawrence, F.J. Gordon and A. Carson), pp. 67-77. British Society of Animal Science occasional publication, no. 19.

Mayne, C.S., McCoy, M.A., Lennox, S.D., Mackey, D.R., Verner, M., Catney, D.C., McCaughey, W.J., Wylie, A.R.G., Kennedy, B.W. and Gordon, F.J. (2002). An investigation of fertility performance in dairy herds in Northern Ireland. *Veterinary Record* **150:** 707-713.

Offer, J.E., Fisher, G.E.J., Kempson, S.A. and Logue, D.N. (2001). The effect of feeding grass silage in early pregnancy on claw health during first lactation. *The Veterinary Journal* **161:** 186-193.

Steen, R.W.J. and Robson, A.E. (1995). Effects of forage to concentrate ratio in the diet and protein intake on the performance and carcass composition of beef heifers. *Journal of Agricultural Science, Cambridge* **125:** 125-135.

Webster, A.J.F (2001). Effects of housing and two forage diets on the development of claw horn lesions in dairy cows at first calving and in first lactation. *Veterinary Journal* **162:** 56-65.

Ward, W.R. and French, N.P. (1997). Foot lameness in cattle. In *Proceedings of the 51st Scientific Meeting of the Association of Veterinary Research Workers* p.19 (Abstract).

Webster, A.J.F (2002). Effects of housing practices on the development of foot lesions in dairy heifers in early lactation. *Veterinary Record* **151:** 9-12.

Woods, S.M., Carson, A.F., Wylie, A.R.G. and McEvoy, J.D.G. (2003). Effects of rearing regimes on milk production and metabolic hormone concentrations in high genetic merit Holstein-Friesian dairy heifers. In *Proceedings of the British Society of Animal Science Winter Meeting* (In press).

Wicks, H.C.F., Carson, A.F. and McCoy, M.A. (2003). Effects of habituation to the milking parlour on the production, health and fertility of Norwegian and Holstein dairy herd replacements. In *Proceedings of the British Society of Animal Science Winter Meeting* (In press).

Profitable milk production – getting the basics right

David French

Teagasc Glanbia Monitor Farmer

Background

The farm is located at Newbawn, Co. Wexford (between New Ross and Wexford), and was transferred to the current owner in 1994. At this time an extra 13 ha (32 acres) was also leased. In 1996, additional land and quota was acquired on a long-term lease. This farm has been a Monitor Farm under the Teagasc Glanbia Joint Farm Development Programme for the last five years. The owner is a member of two Discussion Groups – the local Clonroche Discussion Group, and a group formed from the Teagasc Advanced Dairy Certificate Course (completed in Kildalton in 1998).

Farm Details

The farm comprises 46.5 ha (115 acres), and is fragmented into six separate blocks. Cows have access to 27.5 ha (68 acres), the remainder being used for replacements and cattle enterprises. Twenty-seven paddocks are available to the dairy cows, the furthest paddock being almost 1 mile from the milking parlour. A number of investments have been made in recent times including: - (1997) the purchase of a tractor; (1998) provision for cattle accommodation – which can be used as calving boxes during the calving season; (2000) improvements to milking parlour – eleven units; (1997 – 2001) improvements to farm roadways.

Manufacturing milk is supplied to Glanbia to fill a milk quota of 364,435 litres (80,166 gallons), one-third of which is leased. Sixty-three cows were milked during 2002 with an average milk yield of 5,822 litres per cow (1,281 gallons per cow). Average milk protein percentage was 3.40%.

Average farm stocking rate in 2002 was 2.33 LU/ha (1.06 acres per LU). Replacement rate was 24 per cent (15 heifers introduced to herd) and 26 LU of drystock were carried.

Objectives

To increase farm profits and thereby continue to increase net worth;

To continue to enjoy farming;

To set up the farm so that the average working week is less than 50 hours;

To provide a good standard of living.

Priorities for 2003

To reduce the dairy feed bill to 2001 levels (feed budget prepared);

To measure grass covers on a weekly basis;

To actively seek potential partners for a Milk Production Partnership.

Grassland Management

Aim for a long grazing season. In 2002, cows were out by day on February 13th and out full-time on March 3rd. Housing occurred on November 23rd. Cows had a total of 289 days with grass in the diet. Full-time turnout was earlier in 2002 than in the previous years, but housing date was earlier. Replacement heifers and yearling bullocks are out by mid March, while calves are out by mid April.

Average N application rate was 260 kg/ha (208 units per acre) for 2002. Approximately 2.5 ha (6 acres) are reseeded annually.

Calving Pattern Breeding Performance

Calving generally starts around February 1st (in 2002 calving started on 28th January). The target is to have 80 % of the herd calved by the end of March. The calving pattern for 2002 is shown in table 1.

Table 1. Calving pattern 2002

	Jan	Feb	Mar	Apr	May	Total
Total calvings	2	37	16	6	3	64
%	3	58	25	9	5	100
Start 28/1;			End 8/5;		Average calving date 1/3	

The results of breeding chart analysis for the 2002 breeding season are shown in Table 2.

Table 2. Breeding season performance 2002

Submission rate (%)	86 (55/64)
Conception rate to 1st service (%)	52
Conception rate to 2nd service (%)	64
% Cows not in calf at 13 weeks	9 (6/64)
Services per conception	1.74

The following management practices are carried out in an effort to minimize the number of cows empty at the end of the breeding season:

- All cows are condition scored three times during the year – mid October, December, and April;
- Thin cows are dried off early (1/11) and fed in November and December;
- Pre-service heats are recorded from April 1st. Tail paint is used from this date;
- The vet examines all problem cows on day 1 of the breeding season;
- Heifers are bred at the same time as the cows;
- A teaser bull, fitted with a chin ball, has been used successfully for the previous two years.

Cattle Performance

The aim is for a long grazing season. Both cattle and replacements are rotationally grazed on a paddock system, and moved every three to four days. Finishing animals are housed early (mid October) with the intention of having them sold by the end of January (before the start of calving). This has the added benefit of saving grass in the autumn, which can be grazed by weanlings into early December. A small number of beef heifers are carried each year (6 – 8); these are fed meals at grass from early July and sold in late August. Table 3 shows the average weights and performance of the beef animals born in 2001. These animals were slaughtered in January and February 2003 at an average carcase weight of 318 kg. All graded 'O' with 80 per cent grading 'O4L'. The average price received was €742.

Table 3. Cattle performance 2001, 2002

Date	Average weight (kg)	ADG (kg/day)
9/07/2001	135	
25/10/2001	238	0.94
8/03/2002	317	0.58
9/09/2002	486	0.92
2/12/2002	548	0.70

Farm Profit

A Dairy Profit Monitor has been completed since 1998. This is useful as a means of measuring progress over time and as a means of comparing farm performance with other dairy farmers. The following tables list the profitability of milk production, the enterprise gross margins and other key financial measures.

Table 4. Profitability of milk production – 2001, 2002

	2001 (c/l)	2002 (c/l)	2003 (c/l) (est.)
Milk production (l)	370,390	368,003	380,000
Average co-op milk price	31.5	28.5	29.0
Total dairy output	31.8	30.8	30.1
Meal	1.9	2.5	1.5
Fertilizer	1.5	1.3	1.4
Veterinary	0.8	0.9	0.7
AI	0.6	0.5	0.4
Contractor	0.9	0.6	0.7
Other variable costs	1.2	1.4	1.1
Total variable costs	7.0	7.1	5.9
Machinery	1.5	0.4	0.4
Car, ESB, phone	0.6	0.8	0.7
Depreciation	2.0	2.2	2.0
Other fixed costs	1.2	1.2	1.2
Common costs	12.3	11.7	10.1
Common profit	19.5	19.1	20.0

The objective is to achieve a high milk price and total dairy output figure. The drop in total dairy output was not as big as the drop in milk price during 2002. Common costs have averaged 11.8 cent per litre (42.3 ppg) for 1999 to 2002. The focus is now on reducing costs while maintaining output at a high level. Meal feeding costs were high for 2002. The target is to produce 5,900 litres (1,300 gallons) milk with between 500 to 600 kg concentrates per cow. The average meal feeding level in 2002 was 926 kg per cow. This was primarily due to the weather in late May and June; silage cutting was delayed and there was a grass shortage in July as no aftergrass was available. I valuable lesson was learnt from this experience – graze the silage ground if grass is tight in May!

Table 5. Enterprise and farm gross margins – 2001, 2002

	2001 (€/ha)	2002 (€/ha)
Dairy	3466	3139
Drystock	1441	1901
Replacements	1215	902
Farm	2556	2478

The profitability of the drystock enterprise increased during 2002; this was due to a high beef price in January 2002 and an increase in premia payment rates. It will be difficult to repeat this performance in 2003 as the cattle were lighter at housing and the price obtained was lower than in 2002.

Table 6. Return on investment, net worth change and farm efficiency – 2001, 2002

	2001	2002
Return on investment (%)	10.1	10.1
Net Worth Change (€)	+6,728	+16,908
Farm Efficiency (%)	63	59

NB: Farm Efficiency equals the ratio of total costs to total output.
Return on Investment = (Net Profit plus Interest)/ Total Assets

The 'return on investment' figure on this farm is satisfactory. The mix of owned and leased land and quota and the high farm profit results in a good return on investment, and a happy farmer.

The secret of success?
What are the key factors/management practices that ensure farm profitability? There is no great secret or mystery, pay attention to detail and most importantly, get the basics right!

Long grazing season:-

- Leads to efficient milk production;
- Good weight gains by cattle and replacements;
- Aim to start the last grazing rotation by 10th October at the latest;
- Ensure P and K indices are 3 on all paddocks;
- Apply first N dressing in early January;
- Reseed on an annual basis.

Grass measurement and budgeting:-

- Necessary if want to have a long grazing season;
- Measure covers on a weekly basis;
- Complete a grass budget and **use!**
- Avoid making too much silage – a problem in the past;
- Opening farm cover was 572 kg DM/ha in early January 2003.

Cattle and replacement performance:-

- Cattle and replacements made up 40 per cent of total livestock units on the farm in 2002. Therefore it is essential that profits are maximised from these enterprises;
- Aim for high output at reasonable cost;
- Paddock graze all animals and move every three to four days;
- Minimize the length of the second winter for finishing animals;
- Finish all beef heifers off grass.

Financial budgeting:-

- Prepare a cash flow budget (e.g. Teagasc Cost Control Planner), and monitor receipts and payments during the year;

Breeding season performance:-

- Consider scanning cows before the start of the breeding season (as opposed to the problem cows only);
- Bull selection is important – base selection on protein percentage, modest milk yield lift and strength.

Discussion group membership:-

- Visiting other farms provides window on how others operate;
- Easier to learn from other farmers;
- Time well spent;
- Key factor in improved on farm profitability.

Dairy Herd Monitor/Dairy Profit Monitor:-

- The *Dairy Herd Monitor* monthly reports help focus on key efficiency factors;
- Useful for ongoing comparison with other farmers;
- Deadline for completion prompts record keeping.

Family support:-

- Parents, wife and family absolutely crucial to achieving future objectives.

Teagasc advisory support:-

- Thanks to Tom O Dwyer, Dairy Specialist and Catherine Colfer, Dairy Adviser, for their help over the last number of years.

A strategic vision for the Irish dairy industry

Pat Kenny

Introduction

How many times has it been said that changes perpetrated by the EU., or by world conditions, have been so dramatic as to go to the core of whatever it is that is being considered at that moment in time? What is certain is that the Fischler CAP reform proposals unveiled earlier this year, coupled with the Harbinson WTO proposals and their 'compromise', will go to the core of Irish agriculture particularly the dairy industry.

Position as is

Irish agriculture in its broadest manifestation is fully aware that the WTO negotiation (to begin seriously in 2003 and end in 2005) is coming down the track. The industry was equally aware that the EU CAP review, arising out of an Agenda 2000 decision, was agreed to run to the end of 2006.

The industry did not seem to be unduly upset by the proposals published in July 2002 by the EU Commissioner for Agriculture and Rural Development, Franz Fischler. However, the bombshell arose on January 22, 2003, when Commissioner Fischler issued in greater detail his mid-term review of Agenda 2000.

Commissioner Fischler's view of his new proposals encapsulated in his own statement "*The Commission proposal will provide EU farmers with a clear policy perspective to go with the financial framework until 2013 for agricultural expenditure, as decided by the Heads of Government in October 2002. It will also make European agriculture more competitive and market oriented, promote a substantial simplification in the CAP, facilitate the enlargement process and help to better defend the CAP in the WTO. The proposed adjustments allow maximum flexibility in production decisions of farmers while guaranteeing them income stability. The implementation of the Commission reform would remove environmentally negative incentives in the current policy and provide further encouragement for more sustainable farming practices. These adjustments are necessary to ensure that the EU is able to provide a sustainable and predictable policy framework for the European Model of Agriculture over the coming years*".

At the same time Mr Harbinson (Chairman of the WTO Negotiation on Agriculture), was issuing his 'compromise' proposal on February 17, 2003. The mainstay of this 'compromise' proposal is: -

Tariffs

The product with the highest tariff rate will have the greatest reduction in tariffs.

- For existing tariffs over 90%, a simple average reduction of 60%, subject to a minimum reduction for all products of 45%, over 5 years.
- For existing tariffs in the range of 15% - 90%, a simple average cut of 50%, subject to a minimum reduction of 35%.
- For tariffs of 15% or lower, an average reduction of 40% and a minimum cut of 25%.

EU butter will fall into the first category and most of the other products into the second category.

Special treatment for developing countries

Developed countries should provide for greater opportunity and terms of access for agricultural products of particular interest to developing countries. Developing countries should be allowed to designate a number of products as strategic in terms of food security or rural development. A 10% average tariff reduction would apply to these products, with a minimum cut of 5%.

Export competition and subsidies

For a set of products covering 50% of the current expenditure on export subsidies, export subsidies shall be reduced to zero over 6 years.

In general therefore, combining Fischler and Harbinson together, the omens are not good for Irish agriculture.

Ireland in the EU

At present Ireland, as a member of the EU, is considered to be a developed country. Currently, we are running at 115% of EU average income, and therefore cannot claim to be a developing country. In overview the EU is essentially getting itself into the best shape it can for the WTO debate. By preparing its members with a mid-term review and essential changes, and timing changes, it is putting agriculture, as it sees it, in the best defensible position to defend against the US and other WTO countries in the agricultural debate in WTO.

The changes enunciated by Commissioner Fischler, even if watered down, will affect the core of Irish family farm incomes in the dairying sector. Even allowing for slippage in the WTO negotiations, the probability is that by the end of 2006 a completely changed landscape will exist going forward.

At the time of writing, it looks as if Ireland will opt for decoupling. Payment entitlements will be expressed in a per hectare amount, and be decoupled from production. Farmers will be expected to maintain their land in good agricultural condition. Payment entitlement may be transferred with or without land. National ceilings will apply for payments from 2004.

Cross compliance involving thirty-eight regulations, on food safety, environment, animal welfare etc., will also be obligatory. Failure to comply will carry a penalty. Further modulation and degressivity is proposed from 2007 to 2012. There will be a minimum threshold exemption of €5,000. Payments from €5,000 to €50,000 will be reduced by 1% per annum, up to a total of 12.5% reduction in 2012 and payments over €50,000 will be reduced by up to 19% at the end of that period. The mid-term review is thus a proposal for a 'fundamental adjustment' of the CAP. Effectively it has brought forward a review and enunciated a reduction in support, allied with a move towards world market prices.

Lack of clarity

For the moment, the Fischler proposals are up for debate and discussion, and to be fought for. Nothing is certain except that change will occur, and that this change will firstly be EU instigated, and will then have to be fought for and defended in the Harbinson round of WTO at Doha. Looking strategically forward in Irish agriculture, certain things become clearer.

EU and WTO

When the EU sits down to negotiate seriously in WTO on all world issues affecting the US, New Zealand, Australia, Brazil and Argentina, agriculture (while high on the agenda) will not form the core agenda. There is much to fight for in EU terms. The EU will negotiate as an entity right across the range of intellectual property, technology, engineering, all elements of manufacturing and films, everything that has a world stage. In this context agriculture is only an element. A level playing pitch to serve the emerging markets of China etc., will be a major issue among the big players. Substantial compromises in the interest of the greater EU economy will have to be negotiated in order to conclude the Doha round of WTO, and against that background, agriculture may win, lose or draw.

When one includes the new entrants to the EU from Eastern Europe, and the budget constraints that will arise, it is difficult to see agriculture holding on to the essentials of a price support mechanism into the future. Whilst some form of support and quota systems are likely to continue, dependency on them will diminish as market conditions increasingly come to dominate.

What can we do?

As a nation we must prepare ourselves to ensure that we are in the best possible position to maximise Ireland's natural advantages, and to ensure that there is a future in Irish dairy farming. This must include the big productive units (which may well benefit on a world stage from open competition), the highly productive small and medium sized operators, and also young farmers coming into the industry in the future. This is against a background where Irish agriculture today, is not as relevant to the overall national economy as it used to be in real terms. The total product of agriculture on and off farm is certainly well below 10% of GDP. It is still vitally important, but not as was.

The Irish Government will, no doubt, fight hard within the EU to protect as much as it can those things which are in the best interest of Irish agriculture. However, ultimately one voice in an expanded EU, will no doubt have to compromise and improvise, to reach an overall conclusion.

Self help

Cost effectiveness and efficiency

It is absolutely vital that Irish dairying be absolutely cost conscious, efficient and effective. It is incumbent on each unit of production to ensure that production methods and delivery methods employed per product are state of the art. If this does not happen, survival (all other things being equal) will be made so complex and difficult that it will be impossible to argue the case. It is essential in the debate that, while cost effectiveness and efficiencies are addressed, that there is also regard for the social fabric, even if there is to be an increased dependency on off farm income.

Unit size

The average unit size of the Irish holding for historic reasons is too low to sustain full-time family farm units, more so today because of world price conditions and reduction in subvention and the reduction of protection. What is true is that the average milk production from an Irish dairy farm today is 42,000 gallons. The equivalent figure in Northern Ireland 77,000 gallons. In Denmark and Holland the figure is between 80,000 and100,000 gallons, and in New Zealand 190,000 gallons. If this is considered the viability level (either on protected production or world market condition production), Ireland lies far behind the necessary average unit size based on production.

Where to in the future?

Dairying will have to determine its future as against the backdrop of economic reality. Off farm income will become more important going forward, and it could be that both spouses in a family farm will be earning off farm income. It is probable that the 27,000 currently involved in dairying will be reduced, or certainly have to be more productive or depend on non-farm income. Irish farming should now be looking at leasing options, co-ownership options, joint venture options, partnership options and any other options or structures that help. It should look at modules in other jurisdictions and apply imagination.

In NZ, agricultural land exchanges at about 15% of the total volume of land per year. In Ireland it is probably around 0.7 of 1%. In NZ it is a means to profit and in Ireland it is an asset, a means to profit and emotional. It may be necessary for some to assess maximum usage.

Processing and production

Depending on what elements of milk are taken and where the relatively large niche operators are, there may be up to twenty processors/producers in the production of milk. This makes for uneconomic use of capital, supply difficulties, distribution difficulties and competition difficulties.

In Denmark and Holland there are one or two, and in NZ only one dealing with output. Therefore, strategically from the farm gate, production and processing must be addressed in the greater interest of national efficiency and survival. Also in Ireland, the emphasis is on the production of low value commodities, where all price sensitivity and commodity dangers exist. There are vast quantities of capital required to develop research facilities to bring the production of milk further and export a higher value added product for niche markets.

Who has a role to play going forward?

Farmers, the co-ops and processors, the State (DAF), and the farm representative bodies all have a role to play. There is a need for these groups to address the issues and work in harmony. All of these organisations have got to work together to ensure that a strategic national plan exists for Irish agriculture, and that going forward the plan is adhered to and put into operation.

Flexibility

It is vitally important that in the dairying sector maximum flexibility is brought into any new regime, in particular with regard to the transfer of quota, where the quota goes, who gets it, and what is the criteria for using quota. Economic reality and perhaps breakdown of geographical differentials within the country will have to be addressed in the fullest sense.

The short-term

The short-term must be to defend and maximise while preparing for the reality that things will never be the same again, and that change is now upon us and must be acted upon. As soon as clarity arises from the Fischler mid-term review proposals, there will be a need to establish a forum of all interested parties. These must work together in the greater interest to determine the way forward.

The positives

The efficient cost conscious, cost controlled farmer focused totally on profit may do well, or even better. The green Isle concept, our natural advantage with grass and the cost of production has not been totally exploited and must be. We have a natural advantage in the clean food and clean island image, which we must cash in on. We have invariably done well in adversity and must continue to work together in the greater interest of identifying the advantages, the methodologies and the actions necessary to continue to do so in the interests of the Irish economy, the Irish agricultural economy and the individual farmers who make it up.

There are large markets for us to exploit. We still have leverage in the EU, which we must use to ensure that the changes that are coming are cushioned, and that the lead in and transition periods are such that we have the opportunity to prepare appropriately. The things we are doing today we will not be doing into the future because they will neither be profitable or acceptable. Things we are not doing today we will be doing into the future, and we must identify what they are, why we are doing them and what our profit from them will be.

Social Aspect

Overlying all of the above is the social aspect, where the intertwining of Irish rural society and agriculture are totally interdependent one to the other. The social argument carries a substantial amount of weight that may now be disproportionate to the economic reality. It is incumbent on Ireland Inc., to address the social implication of the Fischler proposals, and what might come out of WTO as it affects agriculture. It will be too late to do this in 2006, it needs to be done immediately as part of the strategic overview of where we are.

Conclusion

There is always a place for good productive business to be carried on no matter what the size of the enterprise, or the unit. There is always a place to niche and succeed.

Initial surveys in Europe, albeit different in impact terms from Ireland, indicate that the certainty, even with reduction into the future, which might be created out of the mid-term review, is in itself a good thing. A certain future for CAP going forward is important.

What is certain is that dairying will prosper and flourish where good productive and production methods are used, costs are controlled and science and research is applied. Also, the marketing of our product and government support is vital, and these things just don't go away because of a mid-term review or a WTO.

Encouraging change in the dairy industry - the Danish/Swedish perspective. Coops - the future

Lars Lamberg
Arla Foods, Amba

Introduction

The cooperative model is the predominant one in the dairy sector in Scandinavia and has been for many years, and is gaining increasing popularity in other parts of Europe as well. It is expected that coops will play an increasing role in the future dairy industry both in Europe and the rest of the world. However, significant listed or privately owned companies will continue to exist alongside. Long-term, the current trend suggests that large international coops and branded conglomerates will occupy the dairy scene.

Coop is a structural solution, but importantly it can also be a business approach. Successful coops do not allow the structure to define the approach – but rather the approach to define the structure. It is believed that the coop approach and increased market requirements combined will contribute towards an accelerated consolidation within the Dairy Industry and possibly also to new formats for doing so.

In general non-coops have tended to concentrate on various kinds of niche production, while coops (in the main) have developed a wider range of dairy products - given their obligation to handle the whole milk volume from members. Nonetheless, the bigger coops have attracted increased milk volume, suggesting them as a vivant model for the future.

As already mentioned, there is an expectation that the consolidation of the dairy industry will continue in the years to come, driven first and foremost by market requirements and secondly by the need for high levels of ongoing investments in efficiency throughout the entire business system. Consequently strong financial capabilities by market participants become a prerequisite. This latter requirement in isolation could be a driving factor behind companies joining forces to provide goods in its broadest sense. It might also be argued that in the long term – specialisation could come on to the agenda, since only a few companies can be expected to have the scale and strength necessary to maintain a fully fledged dairy operation, and the ability to handle all members milk. Elements of such development have been faced for a long time now, and it is no exaggeration to say that the dairy industry in Europe is undergoing a process of serious transformation.

Industry under transformation

New Mergers, acquisitions or strategic alliances involving increasingly larger companies are taking place – if not all the time – then frequently, leaving no room for resting on laurels. The top 5 companies in the EU have increased their milk intake by more than 50 % over a short period of time. The level of international investments has increased significantly over this period.

With a few important exceptions, the dairy industry in the middle of the last century was basically a local industry. Ten years ago, the industry was primarily a regional or national industry. Today, the leading group of companies has an international, or even global set-up.

This development is not only taking place in the dairy industry. It is characteristic of most business sectors, and should be seen as an important indication of the trend towards globalisation. In recent years we have seen an exponential growth in international investment. It is a remarkable development, indicating that we are in the midst of a very important transition of the business world. The transformation process of the European dairy industry however will go on for a considerable period of time. The end is not yet in sight!

A number of factors are driving this development:

1. The *trade/political background* defined by WTO and the EU. Without going into too much detail, it would be fair to say that downward pressure in the earning power of the dairy sector can be expected within the coming years. This results from the WTC agreement as well as EU policy through the implementation, and further development of agenda 2000. The latest proposal from the Commission - a speeding up of the planned reductions in the intervention prices supports this view. Enlargement will also add to this development by intensifying the level of competition and the need for continuous investment in innovation and efficiency.
2. The *EU milk balance and the continued reduction in the number of milk producers*. Milk production among the 15 EU-member countries is expected to continue at the existing level. Enlargement will lead to a significant increase in the EU milk pool, and a corresponding increase in the number of consumers. Therefore the overall balance will probably not be seriously disturbed. However in a number of product areas, we must be prepared for tougher competition from new countries entering the EU.

In Sweden and Denmark there has been a drastic reduction in the number of milk producers over the last 40 years, indicating that income from milk production has been under continuous pressure, particularly on smaller farms. Obviously, as farmers and owners we actively work together with our processing arm to increase efficiency and earnings in the company, in order to generate as high a milk price as possible. However, with the external pressure on milk price, further reductions in the number of milk farmers in Denmark and Sweden are expected over the coming years. On the positive side, milk output will stay more or less at the same level, and the average age of farmers will come down, both implying higher efficiency upstream. These developments will maintain pressure on the coop to continue its own development in order to ensure its earning power, and in this overall context, Arla Foods will contribute positively to consolidation of the industry.

3. *Consolidation within the retail sector.* Out of an ongoing process of mergers, acquisitions and strategic alliances, major retailers are increasingly crossing national borders and expanding into regional market participants. The cross border consolidation in Europe has taken the top 10 retail companies from a market share of 28 % to one of 41 % in the last ten years. Retailers are focusing on cost, choice and service, and in Arla Foods we believe we have to grow to continuously meet the needs of these very large customers. Choice and differentiation of products are some of the major challenges going forward, and will require further cooperation.

Development among retailers themselves has up until now been an important driving force in itself behind the development of the dairy industry, and is likely to continue for the foreseeable future.

4. *Consumer trends* indicate an increased demand for healthy and convenient products tailored to meet specific needs and occasions. It is estimated that by the end of this decade, about 40 % of the turnover in the food industry in Denmark and Sweden will be within the catering & food service sector. Similar trends can be expected in most EU-countries. As dairy consumption is today mainly in the home, this development poses another challenge to the dairy industry. Products, brands, customer and distribution channels will have to be adapted.

These four factors have been key reasons behind the structural development in the dairy sector so far, none of which seem to have been played out yet, so more of the same can be expected in the years to come.

The merger

At the time of the merger, Swedish Arla a domestically based company - were facing the prospect of intensified competition both at home and abroad following on from Sweden joining the EU in 1995. MD Foods had just finalized a long journey of consolidation of the Danish dairy industry, and was heavily biased towards exports. Together the two companies created a strong Scandinavian base with a significant international profile.

Both Sweden and Denmark are small countries population wise. Therefore, the Arla merger can be seen as an early example that it is no longer only enough to look at the national level when considering structural moves on the market. The fact is, that integration of national markets within EU has come far, and structural development within a specific EU-country must be seen as part of the greater picture.

The cooperative consists of approximately 13,600 members - around 7,100 in Denmark and 6,500 in Sweden. The group structure is formed around three core divisions, Sweden, Denmark and the UK, and five other smaller divisions. In terms of Arla Foods, of the 7.2 billion litres of milk processed annually, approximately one billion litres is processed in the UK. Around half of the turnover comes from domestic markets in Sweden and Denmark, with about 18 % derived from the company's activities in the UK.

Today Arla Foods exports to more than 100 countries round the world and has sales offices and/or production facilities in around 20 countries. Regionally we provide the full range of dairy products. Globally we provide butter, cheese, milk powder and other ingredients. Strategy and investment are based on the vision that Arla should aim to be the dairy company, which on a global basis is best at creating value. In Northern European markets, the intention is that Arla should be the preferred dairy company among all stakeholders.

The challenge for co-ops

Rabobank lists the top 21 dairy companies in the world. Nine of these are co-operatives. In general these companies supply the full range of dairy products as opposed to a number of the other companies, who focus on being strong in selected products and niche markets. It can be expected that in the years to come, the major coops will participate in the consolidation process, which in itself will initiate cross border developments.

When MD Foods and Swedish Arla merged in 2000, it was the first cross border merger between coops. The legal framework for such a merger was not clear and issues still remain to be sorted out with both the Danish and Swedish authorities. Other complications included the difference between the two countries with regard to representation of ownership and differences in the milk price and in payment systems.

In Arla Foods it was decided to have a transitional period of three years up to October 1, 2003, in order to harmonize the differences between the two companies. In general Swedish Arla and MD Foods had much in common, so that it probably could be regarded as a reasonably simple alignment exercise. However, the complexity of future mergers should not be underestimated. Appropriate transition periods will be needed to align parties and bridge differences in relevant areas. Protocols will have to be developed to cope with the challenges that cross border mergers of Coops represent. This will not be time wasted.

Conclusion

In conclusion the coop model has by no means outlived its role (as perceived in some quarters!). Rather is it extremely well suited to cope with the challenges in the dairy industry in Europe and elsewhere. Of course non-coop companies will continue to survive and thrive, serving important niche markets, but a major part of dairy products is expected to be supplied by Coops. The future will be challenging for all concerned.

Technologies for profit

George Ramsbottom

Teagasc Grange, Dunsany, Co Meath, Ireland

Introduction

All industries depend on using the most up to date and relevant technologies to maintain their competitiveness. The technologies for profitable dairy farming in Ireland centre on grazed grass. This will continue well into the future.

The costs associated with producing grass silage, in particular second cut grass silage, have risen dramatically over the past number of years. The reasons for this include rising fuel and labour costs, which have increased by 36 and 28 per cent respectively between 1997 and 2001 (CSO 2002a, 2002b). Over the same period, the possible role of alternative forages has been widely debated and publicised in the media. These crops have the potential to reduce the cost of winter forage and possibly increase profitability. While the overall contribution of such forages may be small, on individual farms their potential impact on farm profitability may be substantial. However, it is still important to maintain focus on grazed grass as the principal and cheapest forage available to Irish dairy farmers.

Grassland management on dairy farms

The argument in favour of grazed grass centres on three issues:

It's role as the cheapest ingredient in the cow's diet;

It's ability to increase milk protein content;

Ultimately it's potential to increase the profitability of production systems.

Total grass intake

Recent research at Moorepark with spring calving cows has shown that it is possible to produce over 6,500 kg (1,388 gallons) of milk from spring calving cows calving close to the start of the grazing season. On dry mineral soils, stocked at 2.4 cows/ha (1cow/ac), such animals will consume almost 70% of their annual dry matter intake as grazed grass with the balance made up of grass silage and concentrate. The quantities and costs of these three ingredients fed at the Curtins 'low concentrate' system is presented in Table 1.

While it forms over two thirds of the cows diet, grazed grass accounts for just over half of feed and forage costs. Concentrates, comprising less than one tenth of the total diet account for approximately one seventh of feed and forage costs. Silage makes up one quarter of the diet and accounts for just under one third of total feed and forage costs

Table 1. Volume and estimated costs of ingredients in the diet of a 6,540kg spring calving cow

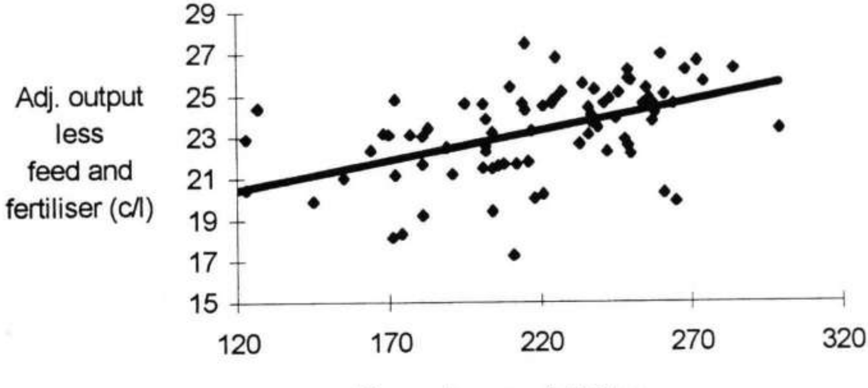
Ingredient	DM/cow/year (kg)	% of diet	Total annual cost (€/cow)	% of feed and forage costs
Grazed grass	3291	68	294	54
Silage	1198	25	174	32
Concentrate	340	7	77	14

Source of dry matter inputs: J. Kennedy, personal communication
Costs of grass and grass silage based on O'Kiely (1994) (adjusted for inflation to 2002); Concentrate costs based on average of 81 Monitor Farms in 2002.

Increasing grazing days

Calculations of the relative costs of the different ingredients in the cows diet suggest that as the proportion of grazed grass in the diet increases, the margin over feed and forage should also increase. Research from Moorepark suggests that each extra grazing day increases profit by €1.06 per cow. This supposition is again supported by evidence from Teagasc Monitor Farms. Data was analysed using the Teagasc financial programme 'Dairy Herd Monitor'. The data presented in Figure 1 was obtained in 2002 from 81 winter and spring milk producers located from Louth to Kerry.

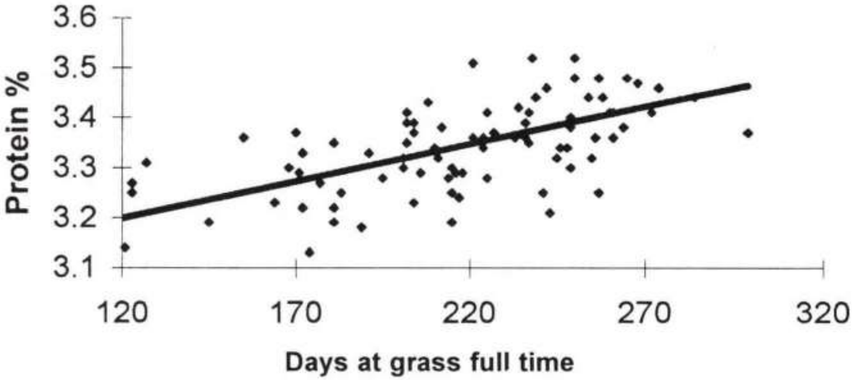
Figure 1. Trend in number of days of full time grazing and adjusted[1] output less feed and fertiliser on 81 Monitor Farms in 2002



The data show that as the number of days of fulltime grazing increases, output less feed and fertiliser tended to increase. Output less feed and fertiliser increased by €1.56 per cow per extra days full time grazing. Every month of extra full time grazing increased output less feed and fertiliser by over €1,900 per 227,000 litres of milk produced.

The second reason for focusing on grazed grass is the effect that grazed grass has on milk composition. Part of the extra €1.06 profit realised per cow per days grazing in the Moorepark model is due to an increase in milk protein content. Data from the same Monitor Farms confirms the trend for protein content to increase as the number of days of full time grazing increased (Figure 2).

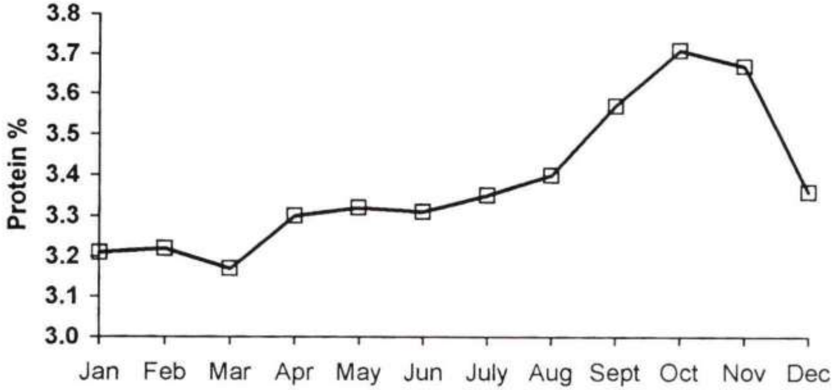
Figure 2. Trend in the number of days of full time grazing and milk protein content (%) on 81 Monitor Farms in 2002.



The data show that milk protein content increased as the number of days of fulltime grazing increased. On average milk protein content increased by 0.045% per month of full time grazing. Such an increase is worth 0.22c/litre or €518 for every month of extra full time grazing per 227,000 litres of milk produced.

Grass however is not without its deficiencies and they are reflected in the changes in monthly milk protein content for spring calving cows on grass-based diets (Figure 3). The trend in monthly protein content of the milk supplied by 66 spring milk Monitor Farmers reflects the two weaknesses of pasture-based diets. The data in Figure 3 is data from 66 spring milk Monitor Farms where forage formed 87% of total diet and cows spent an average of 260 days at grass. The drop in average protein content in March reflects the seasonal drop in protein content of the freshly calved cow. The move to grass earlier in lactation has lifted the lowest point milk protein content by approximately 0.2%. In herds where spring calving cows go to grass after mid-April, it is not unusual for protein content to drop below 3% in March. The drop in protein content in the November/December period reflects the fall off of grass supply in the late autumn. The drop in June is due to supply and quality issues with grass on some farms in short supply before after-grass from first cut silage becomes available. On other farms the quality of available pasture declines as grasses head out in the late May/early June period. One of the recommendations from the Monitor Farms component of the Teagasc Kerry programme was that grass digestibility should average 82-84% in the mid-summer period.

Figure 3. Average 2002 monthly milk protein content on 66 spring calving Monitor Farms.



Technologies that improve profit

The data presented from research and from on-farm analysis show that the technologies that improve profit on dairy farms are those that increase the number of grazing days in the diet. Two of the key technologies are:

- Grass budgeting;
- Compact calving.

In focusing on these two technologies, it is assumed that other aspects of grassland management are deemed satisfactory, e.g.:

- Soil fertility is adequate;
- Swards are principally composed of late heading perennial ryegrass;
- An effective roadway system is in place permitting access to all of the grazing area (especially important in early spring and late autumn);
- Quota management is good and average lactation length is between 280 and 300 days.

The issues to do with stocking rate and silage cutting date will not be considered here.

Grass budgeting

Increasing the number of days at grass can be achieved without resorting to budgeting. However, grass growth rates vary between years and between seasons. Budgeting overcomes the inaccuracies inherent in this variability of supply. It allows the farmer to accurately assess whether or not concentrates are needed. It helps prediction as to when farm cover is coming into surplus or deficit. It enables a planned respond in advance of an impending deficit either by reducing stocking rate or supplementing. In essence budgeting provides a competitive advantage over other dairy farmers. A secondary effect of budgeting is its impact on grass quality. The timely removal of surpluses helps maintain grass quality throughout the grazing season, lifting grass intakes and improving milk composition.

Kelleher (2002) reported that while almost all discussion group members were aware of grass budgeting, only a small proportion were practising the technique. Plate meter and 'cut and weigh' methods of assessing grass cover are available. However, most farmers will only continue to use a system of grass budgeting if it can be done quickly, and deliver a result within 1-2 hours. The eyeball method has a lot to offer in this regard. Once learned, it allows the grass manager to quickly estimate pasture covers and, combined with a computer spreadsheet, keeps the time needed to calculate average farm cover to a minimum. A set of target farm covers for season and stocking rate is available (O'Donovan *et al.*, 2000) (Appendix 1) against which the cover can then be compared and management decisions made.

Compact calving

Targets for a compact calving pattern are 75% of the herd calved (95% of heifers) in the first 6 weeks of the calving season with the balance calving over the next 7 weeks. Failing to calve compactly affects profitability. One estimate showed that compared with March calving cows, the milk produced from January calving cows cost 1.51 c/litre more; that from February calving cows cost 0.59 c/litre more and that from April-calving cows cost 0.31c/litre more to produce (Crosse *et al.*, 1994). This economic analysis warrants re-evaluating as earlier full-time turnout is now being achieved than was envisaged when the calculations presented in the paper were formulated. Achieving compact calving is dependent upon developing a breeding plan where both management and genetic decisions are set out well in advance of the breeding season.

Effective farm-proven breeding plans have been developed to achieve compact calving (Teagasc, 2002). Key elements of successful programmes include:

- Monitoring condition score during the dry period, and condition score changes pre-breeding and during the breeding season. Targets are 3-3.25 for cows and heifers at calving with condition score falling to no less than 2.75 post-breeding;
- Calving heifers just before or at the start of the main calving season (using synchronisation);
- Maintaining accurate records of calving dates, problems etc.;
- Using pre-breeding heat detection to identify and induce heat in anoestrus cows in advance of the breeding season;
- Dates and targets set and clearly laid out on a chart for all of the events to take place during the breeding season;
- Scanning pre-breeding to identify non-cycling cows and again at 8-9 weeks into the season to confirm pregnancy. A clear programme developed to treat cows thought to be pregnant to this mid-breeding season scan but found to be empty;
- Tail painting during the season and using a vasectomised bull to improve heat detection.

Management alone will not achieve excellent herd fertility. A high heat detection rate may mask some of the consequences of low conception rate. However cows genetically predisposed towards poor fertility will have a higher empty rate at the end of the breeding season no matter how excellent is the breeding season management plan. At the end of the 2002 breeding season on the Teagasc Curtins farm, 31% of the high yield cows were empty compared with an 8% empty rate for the two strains of Holstein Friesian bred for higher fertility – the 'High Durability' and New Zealand strains.

Research at Moorepark has identified two potential approaches to breeding cows suitable for grass-based milk production.

- Breeding from Holstein Friesian sires within the EBI that have good fertility proofs (i.e. positive for survival %, negative for calving interval).
- The fertility benefits of crossbreeding are well researched (Harris and Winkleman, 2002). Research at Moorepark with crossbreeds is underway. Results to date indicate that compared to Holstein Friesian cows, crossbred Montbeliarde X Friesian and Normande X Friesian cows are comparable in terms of milk yield (between 5,430 and 5,520 kg/cow) and milk solids (between 384 and 398 kg/cow) at medium concentrate feeding levels (548 kg per cow). Only 11% of the crossbred cows were empty compared with 31% of the Holstein Friesian cows after a 13 week breeding period.

Conclusions

The focus on alternative forages for dairy cows must not take dairy farmer's eyes off what must be their principal focus, grazed grass. Increasing the number of days at grass increases dairy profitability. Grass budgeting and a planned breeding season resulting in compact calving timed to coincide with the grazing season will increase the number of days at grass.

Grass budgeting underpins grass supply and quality and so the practice needs to be adopted onto all dairy farms. Compact calving to grass is critical. Fertile cows obtained using the EBI or by crossbreeding to high genetic worth alternative sires have a role to play. Neither genetic route will ensure compact calving and a low empty rate without a clear breeding plan prepared well in advance of the grazing season. In conclusion '*... a lot of people ... are not the best farmers because they haven't become expert in the basics of pasture farming, yet they want to move on to high-input farming.*' Dr. Colin Holmes, Massey University speaking at the Dairy 2003 Conference, Hamilton, New Zealand.

References

Crosse, S., O'Farrell, K. and Dillon, P. (1994) Why calving date and compact calving are so important to profitable dairying *Proceedings of the Irish Grassland Association Dairy Conference* Irish Grassland Association

CSO (2002a) Agricultural Price Indices Central Statistics Office, Dublin

CSO (2002b) Earnings of Agricultural Workers Central Statistics Office, Dublin

Harris, B.L. and Winkleman, A.M. (2000) Influence of north American Holstein genetics on dairy cattle performance in New Zealand *Large Herds Conference*, Canterbury, New Zealand

Kelleher, B. (2002) Research to practice – the experience with monitor farms Teagasc National Dairy Conference Teagasc, Dublin

Mee, J.F., Fahey, J. and Crilly, J. (1999) Breeding the dairy cow of the future : today's challenges Teagasc National Dairy Conference, Teagasc, Dublin

O'Donovan, M., Dillon, P. and Stakelum, G. (2000) Grassland measurement : benefits and guidelines Teagasc/IFI Publication

O'Kiely, P. (1994) The cost of feedstuffs for cattle IAWS Technical Bulletin No. 6 IAWS, Dublin

Teagasc (2002) Breeding the spring calving dairy cow Teagasc, Dublin

Appendix 1. Target average farm (kg Dm/ha) and per cow (kg DM/cow) grass covers for the March to June period.

Date	Target cover per cow (kg DM)	Target Farm cover (kg DM/ha)	Stocking Rate (LU/ha)
Mar 04	253	608	2.4
Mar 11	265	636	2.4
Mar 18	263	631	2.4
Mar 25	260	623	2.4
Apr 01	145	651	4.5
Apr 08	170	765	4.5
Apr 15	163	734	4.5
Apr 22	166	748	4.5
Apr 29	184	830	4.5
May 07	202	909	4.5
May 13	230	1035	4.5
May 20	233	1050	4.5
May 27	235	1059	4.5
Jun 04	222	998	4.5
Jun 10	223	1003	4.5
Jun 17	233	1050	4.5
Jun 24	292	1050	3.6

[1] Adjusted to exclude different milk processors milk price by setting a standard value for milk fat and protein content.

ICOS vision for the Irish dairy sector

John Tyrrell

Director General, Irish Co-operative Organisation Society

Introduction

Last September, the International Diary Federation held a major Dairy Congress in Paris. This provided an opportunity for dairy farmers, processors, scientists, academics, policy makers, marketers and politicians to come together to consider a wide range of themes relating to dairying. The themes considered, related to health, nutrition, consumer trends and communication, product promotion, safety and retailing. Few could fail to be impressed by the enormous potential of the industry, and the opportunities that the growing diversity among consumers provides. It is easy to forget that in milk, the dairy industry has a product that is so versatile, that it can be presented in more forms than nearly any other naturally produced commodity.

What strategy should the industry (farmers and processors/marketers) adopt in order to meet the requirements of consumers and provide a prosperous future for the stakeholders in the industry?

Strong points

The Irish dairy industry has a number of strong points:

- As part of the EU Ireland (Irl) has access to a large, wealthy and growing market;
- Although relative competitive advantage may have been eroded somewhat in recent years, IRL is still a low cost producer of raw milk, with climatic and environmental advantages, which provide cost and consumer image advantages;
- Production scale at farm level is above the EU average – although it is below that in Holland and Denmark which are significant EU export competitors;
- Irl has a strong integrated structure with farmers co-operatives involved in farm supply, milk collection, processing and marketing of milk and milk products;
- There is strong export dependence – approximately 80% of the milk produced is exported. A number of indigenous food companies and co-ops have expanded overseas to process, market and distribute dairy products of Irish and foreign origin, thus providing valuable access to information and marketing channels in overseas markets;
- The industry has taken steps to consolidate and organise to meet future challenges, however the pace of this change is not as rapid as it is among competitors.

Weak points

It should also be recognise that the Irish dairy industry has a number of weak points:

- Milk yield per cow and component concentration are below those of our competitors;
- Ireland has a very seasonal milk supply pattern, resulting in significant over capacity, which is only fully utilized for 2 months in each year. This adds greatly to this cost of

processing. Recent trends indicate that this seasonality effect is increasing as more farmers seek to produce all their milk off grass and winter milk schemes are scaled back;

- Processing margins are lower than that of our main competitors due to seasonality, a lower scale of production, different product portfolios, and the focus of co-ops to pay the best possible price to producers;
- Due to the way the industry evolved from a small domestic market with a traditional emphasis on the production of butter and SMP, there is heavy reliance on low growth and low margin products. Such products have been supported by the EU dairy support system, and can only be exported in a dried or preserved form, capable of being transported and stored.

A number of factors are going to influence the future of the Irish Dairy Sector.

W.T.O. negotiations –Doha Round

The EU has committed itself to further reductions in tariffs and supports in these negotiations (launched in Doha in December 2001). This will have the effect of reducing the level of protection against imports, which can be applied by the EU The EU's opening offer proposed reducing tariffs by a further 36% on average, and a cut in export refunds of 45% (Irl has been assured by the Commission that the EU offer is within the Agenda 2000 agreement). The Chairman of the Agriculture Negotiations, Stuart Harbison, has proposed even more severe reductions in tariffs and export refunds. The effect of any outcome on the lines of the Harbison Proposals would be to open the EU dairy market to more imports and to reduce the quantity of dairy product that can be exported from the EU The precise impact will be unclear until the negotiations are completed.

Mid Term Review of Agenda 2000

The Commissions Mid Term Review proposals which were published in January 2003, propose:

- A further 10% cut in support price beyond that proposed in Agenda 2000 (Now total cut of 25% is proposed);
- Further proportionate compensation for this price cut in the form of direct payment;
- Continue quotas until 2015;
- Limit on annual quantity of butter which may be purchased into intervention;
- Decoupling direct payments;
- Modulation of direct payment i.e. transfer a percentage of the direct payments for each farmer above certain thresholds into funds for rural development or reform of other sectors.

Industry Structure

<u>Primary/Production</u>

- Professor Boyle's study on competitiveness of dairy farming has shown that Irl's cost advantage over 7 other EU countries has gradually fallen over the 10 years up to 1999. This has been due in part to cuts in cereal supports – making cereals more competitive, the introduction of the maize silage premium and to Irl's higher rate of inflation.

- Average milk quota in 2001 was 180,000 litres and average herd size is 45.7 cows. Professor Boyle also pointed to the relatively low scale activity on Irish dairy farms as a contributing factor to our weak competitive performance. He pointed to the link between greater efficiency and lower production costs with greater scale on farms.
- Policies for restructuring quota in Irl have been determined by a consensus-based approach, which has included Department of Agriculture, Teagasc, farm organisations and co-operatives. This has also recognised the need to support smaller scale producers and dairying in less favoured areas, which is a result of lower average supply and more dispersed supply pattern than other parts of the country.

Rate of milk quota restructuring has been slower than in some EU countries.

<u>Processing Sector</u>

- There are currently 15 processors of milk, plus baby food and chocolate crumb manufacturers. Liquid milk is not included in this figure as it satisfies local and regional markets.
- Six processors account for 80% of Ireland's milk pool. When compared with processors in Netherlands, Denmark and New Zealand, this demonstrates that our scale is significantly smaller than our competitors.
- There has been steady consolidation of the Irish Dairy over the past 15 years and further progress has been made over the past 3 years, but much more remains to be done.
- The recent Prospectus Report on the Irish Dairy Sector analyses the industry and provides comparison with the performance of our competitors.
- At an international level, dairy companies in France (Bel, Lactalis and Danone) are expanding at a rapid rate outside France, to such an extent that over 50% of their total sales are outside France. They believe that growth can only be achieved in foreign markets.

Many other foreign dairy businesses are focussing on specialising their production sites, investment in higher value added, high brand profile products and expanding into markets in Eastern Europe, Middle East and Asia.

The amounts spent on new product development, reinvestment research and development is lower in Irl's dairy industry than among our competitors in Denmark and the Netherlands. According to the Prospectus report, Irl's expenditure on R & D was 0.2% of turnover, which is well below the levels in the Netherlands (0.4%) and New Zealand (0.6%). Ireland's reinvestment rate is 2.6% of turnover, which again is less than the industry average in the Netherlands (2.8%), New Zealand (4.8%) and Arla (4.5%).

The recommendations from Prospectus highlight an enormous challenge for our Industry. They have estimated that for our industry to rationalise and shift its product portfolios to higher value products, an investment of Euro 300m will be required, which will be mainly incurred in the early years. Payback will be of the order of 70m pa – according to Prospectus, but there will be a six-year payback period.

Market/retail/consumer trends

There are a number of trends in the market, which the dairy industry must be conscious of as it prepares for the future. Many reports have been written which detail these trends, e.g.

- Globalisation/regionalisation of markets, customers and competitors. There are an increasing number of businesses operating on a regional and global scale. Businesses such as Nestle, McDonalds, Coca Cola are international brands, which benefit from significant brand support. In the dairy sector Danone, Yoplait, Mueller are well known and supported international brands. The Kerrygold brand is Irl's most recognised international dairy brand;
- Growing scale and market share of retailers. Many of the retailers have now developed in more than one country and are expanding significantly beyond their original market. Examples, are Walmart (US) now in UK, Germany, Tesco, Royal Ahold, Aldi are expanding their business models across Europe.

This very large scale is giving them enormous buying power and they are passing more of the costs onto suppliers. An example of this is demanding contributions to advertising and promotion, merchandising, development of own label products. These supermarkets work together with food manufacturers to exploit opportunities that exist in the sophisticated marketplace in which increasingly affluent and aware consumers are looking for convenience, quality and safe food. Consumers also have less time to purchase, prepare, cook and consume their food.

The food service sector has also been going through dramatic change and rapid growth. Estimates suggest that this sector is growing at twice the rate of the retail sector. This sector, which has also shown significant consolidation, includes restaurants, fast food outlets, hotels and the catering sector. Some of the food service operators are globally branded operators such as Pizza Hut, Kentucky Fried Chicken, and McDonalds etc. These companies offer consistent product regardless of where in the world it is sold. Food service operators therefore demand a very consistent quality of product in order that they can supply to all of their outlets. A number of Irish dairy co-ops and companies supply the food service sector including Glanbia, Kerry, Dairygold, Carbery and others.

Consumers are also seeking functional foods in an effort to achieve balance in their diet. This is an effort to make up for nutritional shortfalls from fast foods, ready meals and no breakfast in many cases. They are looking for products that will provide them with the essential proteins, vitamins and minerals and other supplements to make up for their modern eating habits. Functional foods and nutritional solutions is a major growth sector.

Vision for the dairy sector

The objective for the Irish dairy industry should be to optimise the value of the sector by developing a strategy to produce, process and market milk products in a way that will create sustainable long-term value for producers, employees and consumers.

In order to deliver this objective a number of steps will need to be taken.

- Ireland must aim to be efficient and competitive at primary and processing levels. Recent reports such as Agri 2010 Report, Prospectus Strategic Development Plan for the Irish Dairy Sector and others recommend that a national, average milk production per farm of 70,000 gallons (or more) is required to ensure viability. How can this target be achieved? It will require a change of thinking among farm organisations and policy makers in the light of the new challenges (Mid Term Review, Cost/Price Squeeze, loss of competitiveness), which are being faced

- How can account be taken of the importance of milk production to the economy in less favoured areas and the shortage of alternatives in agriculture in those areas? Are there changes needed in the implementation of national and European Union schemes, which would help to improve our competitive position at farm level?
- There is a need to create a dynamic and innovative industry that is focussed on the needs of the market. Ireland has a significant dependence on products that receive support from the milk regime of the CAP. Under the European Commission's proposals, the support measures are to be reduced, which will have a greater impact on Irl because of the current product mix.
- We will have a choice to make.
- Either our focus for the future can be on commodities, in which case we will have to be as efficient as the best or we will lose out.
- Alternatively, we can develop value added products for consumer, food service, food ingredient and other specialist sectors that will not be reliant on public policy support.
- We should recognise that the value added route is not one, which will yield results quickly because of the long lead-time, and it will be costly.
- Our industry has a strategic choice to make. This will require a significant investment. I expect that we will have combination of commodities and added value products, which will involve a focussed effort to increase the share of total milk going to the higher value products. We need to set targets for this shift in order to decide how our processing assets are configured and where investment will be made. The Prospectus Report has recommended that we set a target of changing the product portfolio mix from 65% for base products at present, to 45% by 2015.
- In New Zealand a number of years ago, the New Zealand Dairy Company (the larger of the 2 processing co-ops which merged to form Fonterra) decided to select from amongst their 11 or 12 processing locations, that they would focus their investment in about 4 mega sites and that the remaining locations would be phased out and closed over a 5-10 year period.
- Our competitors in the Netherlands, Denmark, New Zealand, Germany and elsewhere have adopted aggressive strategies in order to achieve efficiency and cost effectiveness. These have included increasing the scale and efficiency of dairy processing facilities and gaining from economies of scale.
- The Irish Industry needs to adopt a similar aggressive strategy by increasing the scale of processing facilities for the bulk products such as butter, SMP, WMP, cheddar cheese and casein.
- Ensure that our dairy industry is controlled by milk producer shareholders and operates for their benefit and for the benefit of their customers.
- There are a number of issues, which arise from the shareholding, control and governance in co-ops, which arise in the context of the changes that the industry will experience.
- Shareholding by milk producers in co-ops does not reflect the business, which that producer carries out with the co-op. While a number of co-ops operate patronage bonus schemes, thereby distributing part of the annual financial surplus in the co-op to those members who traded with it, perhaps we should look at the case for operating

a share standard similar to that, which operates in many U.S., Australian and New Zealand co-ops. This would require a producer to hold a given number of shares in the co-op for every 100 litres of milk, thus as producers expand they purchase shares and as producers leave or retire they have their shares redeemed. In this way a producer's investment in the co-op would reflect the investment, which the co-op makes on his behalf to process and market his milk.

- Another issue that arises is the necessity to ensure that the Boards of co-ops are made up of the best and most capable people to govern the co-op. The democratic system of election is operated in all co-ops. Training programmes are available for co-op directors and should become a condition for all newly elected members. Ongoing director development is also essential.
- Directors of co-ops should be paid a director's fee, which reflects the responsibilities, and time, which directors have to make available to their co-op, and the time that directors give up on their own farms to fulfil their duties as directors.
- In some countries such as the Netherlands and the US, co-operatives elect some of the directors from a pool of suitable candidates, which are drawn from the membership. This pool of candidates may have particular skills, expertise or leadership qualities or may have completed an approved advanced development programme. Should this be considered in Ireland?
- Co-ops in many countries now appoint independent directors to their Boards. In Fonterra for example 4 of the 13 directors are appointed as non-farmer directors. This reflects the growing complexity of the business and the need for skills on the board, which can only be found in this way.
- We want to have an industry that encourages excellence in producers, management and staff and is fully aware of the importance of their contribution.
- Consumers are showing a greater interest in where their food comes from, how it is produced, conditions under which animals are kept. They are looking for assurance that what they eat will be safe and will be produced under conditions that they are happy with.
- The industry at every level must take account of these consumer concerns. The food chain is a partnership and must have no weak links. All parties in that chain has to work to apply the standards that the consumer expects – not just the minimum statutory standards.
- Farmers control most of the Irish Dairy Industry through their co-operatives. They are in a much better position than the beef sector (which has only a very small co-op involvement in processing) and the sugar sector, where farmers are in a weak bargaining position. However, it is in farmers' interests to influence the vision and strategy for the future development of the dairy sector. It is their industry; they will be beneficiaries of its success. Those who will be in dairying for the future should become actively involved in their co-ops and make their contribution through the relevant structures.
- Our co-op structure has provided a sound basis for development so far. We should build on what we have, and develop a dairy industry that will deliver the objective of a prosperous future for Irish dairy

Labour efficiency on drystock farms: a core issue for the future

P. Bolger[1] and J. McNamara[2]

[1]*Irish Farmers Journal*

[2]*Safety and Labour Specialist, Teagasc*

Introduction

Labour is a declining resource available to Irish farming. Central Statistics Office data indicates that total labour input has declined, on average, by 3.4% per year since 1991. However, the Teagasc Grange Labour Study (TGLS) indicates that there is considerable variation in the labour input on suckler/drystock farms in Ireland (Leahy *et al.*, 2003a,b,c). This research indicates that the most efficient 25% of farms in the study used less than one third of the labour input of the least efficient 25%. Both the declining availability of labour, and the variation identified in labour use on farms should challenge drystock farmers to 'benchmark' labour use against the most efficient group. This should be followed, where necessary, by implementing strategies to improve labour efficiency.

This paper examines issues of labour use in relation to farm income and efficiency. The use of work time in relation to quality of life is also explored.

Labour use in relation to Income

When family farm incomes are related to hours worked, it becomes apparent that, on average, drystock farmers are the lowest paid sector in society (Table 1). This information should provide a challenge to strive to earn an income per hour at least comparable with the average industrial wage, which can only be done by optimising both the efficiency of farming and hours worked.

Table 1. Gross earnings and hours worked for various occupational groups

	Earnings		Hours
	€/hour	€/week	worked/week
Electricity, gas and water supply[1]	19.95	814.93	40.9
Mining and quarrying[1]	15.47	702.42	45.4
Manufacturing[1]	12.72	498.90	39.2
Agricultural workers[2]	8.16	333.77	40.9
The average farmer[3]	8.23	304.00	37.2
Social welfare (2 adults, 2 children) [4]		241.20	
Cattle farmers[3]	4.16	139.96	33.6

Source: [1]CSO Industrial earnings and hours worked March 2003; [2]CSO Earnings of agricultural workers 2001; [3]National Farm Survey 2001; [4]Department of Social Community and Family Affairs Guide for Unemployed People 2002

(Note: Earnings per week is the average family farm income (FFI) 2001 (€15,840) for all farms divided by 52 weeks. Earnings per hour are FFI divided by family labour units (1.08) for all farms).

With the impending implementation of the 'single farm payment' following the recent Mid-Term Review (MTR) of the Common Agricultural Policy (CAP), income from farming net of the 'single payment' will become transparent. It is unlikely that any farmer will want to channel a proportion of their per hectare payment towards the running of the farm. However, it is difficult to see how commercial agriculture without supports will become a paying proposition in its own right (Table 2).

Table 2. The contribution of direct payments to family farm income

	Cattle rearing €/Farm	Cattle other €/Farm
FFI including direct payments	7,278	7,822
Direct payments	6,439	8,674
FFI less payments	839	-852

Source: National Farm Survey 2001

Following the MTR, farmers will radically rethink their systems of farming with economic return and labour input becoming key parameters in any efficient system. Becoming extensive in an effort to hold onto as much of the single payment could leave some farmers financially better off, especially where off-farm employment is available. However, committed commercial farmers will in the future 'farm for profit and not for numbers'. It is likely that farmers currently operating efficient and profitable enterprises have the formula for success going forward. Figures from the Teagasc National Farm Survey (TNFS), Management Data for Farm Planning (MDFP) and the TGLS, demonstrate actual and potential performance at farm level (Table 3).

Table 3. A comparison between actual and potential performance of suckler and cattle units

	Suckling		Cattle	
	Actual[1]	**Potential**	**Actual[1]**	**Potential**
Gross margin/farm (€)	14,822	17,813[2]	17,305	19,946[2]
Fixed costs (€)	7,544	8,847[3]	9,483	9,285[3]
FFI (€)	7,278	8,966	7,822	10,661
Area farmed (ha)	30.3	30.3	31.8	31.8
Total L.U.	30.2	54.5	39.6	57
Stocking rate (L.U./ha)	1	1.8	1.24	1.8
Hours per L.U.	58	19.16[3]	42	19.16[3]
Return/hr worked (€)	4.17	8.59	4.67	9.76

Sources: [1]National Farm Survey 2001; [2]Management data for farm planning (single suckling and calf to 2 years with a 'good' level of performance); [3]Teagasc/Grange labour study most labour efficient farmers

Under the current CAP system, the potential earnings of individual farms are double what are actually being achieved. Stocking rate and labour requirements are the noticeable differences between potential and actual situations, however farm efficiency factors are also involved. Achieving an 'excellent' level of performance and minimising fixed costs has the potential to increase return per hour worked by a further 30%.

Research to establish the precise relationship between work time input and profitability in drystock farming has yet to be concluded. However, the generality of information from labour studies in other enterprises suggests that efficient labour use goes hand-in-hand with profitability. Data from the TNFS (Table 4) gives a very clear indication on where drystock farmers should be spending most of their time - namely, on work activities related to optimising profit. These include work and facilities related to achieving low cost livestock weight gain of high value output.

Table 4. Economic margins from 'top' and 'bottom' cattle farms

	NFS bottom 1/3rd	NFS top 1/rd	Advantage
Gross margin €/ha	193	630	+437
Premia €/ha	215	311	+96
Fixed costs €/ha	210	292	-82
Profit €/ha	-17	339	+355

Source: Teagasc, National Farm Survey, 2001

Labour use at farm level

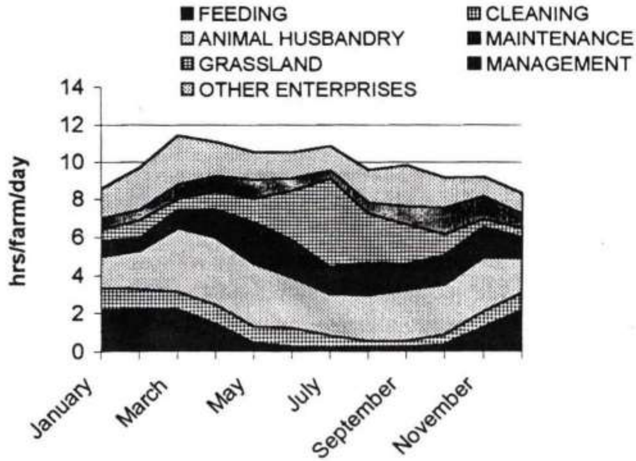
The TGLS on suckler/drystock farms gives a good insight as to what is happening at farm level regarding labour use. The 115 suckler farms in this study had on average, 93 cattle livestock units, with an average suckler herd size of 54 and land area of 72 hectares. The average labour input over the 12-month period was 9.90 hours per farm per day. The average labour input peaked at 11.45 hours per day in March and was lowest in December at 8.32 hours. Labour efficiency as measured in hours per livestock unit per year varied greatly (Table 5) ranging from 11.71 to 116.05 hours per livestock unit per year.

Table 5. Grange/UCD labour study of labour use on 115 sample suckler farms

Efficiency level	Average hours/L.U./year
Most efficient 25%	19.16
Middle 50%	33.98
Least efficient 25%	65.04

The TGLS (Figure 1) indicates that most time is utilised at animal husbandry tasks, which average 2.58 hours per day over the whole year.

Figure 1. Teagasc Grange/UCD labour study: total labour input (hours per farm day) for predefined tasks. All farms (115 farms)



Source: Leahy *et al.*, (2003a)

This task used 3.37 hours per day in the months of March, April and May. Grassland management and feeding are also time consuming tasks using 1.51 and 1.15 hours per day, respectively, throughout the year. Grassland management peaked in July at 4.63 hours, the majority of which was accounted for by silage making, topping and fertiliser spreading. Time allocated to feeding stock, declined from 2.24 hours in March to 0.23 hours in July. Maintenance and cleaning required a steady demand for labour, averaging 1.41 and 0.78 hours per day throughout the year respectively. Notably, management averaged 0.78 hours per day throughout the year. Included in this task is 'office work' such as record keeping and trading of stock (Leahy *et al.*, 2003a).

Factors leading to a labour efficient farm

In the TGLS many factors were found to influence labour efficiency. These included: farm size (hectares, herd size), other farm enterprises, land quality, farmland and farmyard fragmentation. Over the spring period (March, April, May), the greater the distance from the dwelling house to the calving unit, the longer the working day devoted to suckling tasks. Over the winter months (November, December, and January), labour input increased with the number of feed areas on the farm. Over 70 % of farmers who participated in the study said that their farm buildings and facilities could be improved to reduce labour requirements (Leahy *et al.*, 2003b). Use of mechanical aids for bedding, using calving observation cameras and keeping records on services and returns to heats were positively associated with efficient use of labour (Leahy, *per. comm.*). Calf health problems in contrast had an adverse impact on labour efficiency (Leahy *et al.*, 2003c).

A study investigating current and future labour issues on farms in Tipperary South Riding (Ruane *et al.*, 1999) indicated that from a labour use perspective, 26 % of those surveyed, needed to pay more attention to methods used for feeding cattle.

Characteristics of labour efficient drystock farming

Every farm has a unique set of circumstances that affect labour requirement. These include: availability of labour, farming system, farm layout, buildings and farm fragmentation. Therefore approaches to achieving efficient use of labour need to be tailored to suit individual farms. The following areas are likely to be crucial to achieving labour efficiency:

Buildings, farmyard and farm layout

- Buildings and farmyard must be designed to allow for efficient management and movement of stock (in the main by one person) to calving facilities, crush, and loading area.
- Mechanical feeding equipment should be used and sized to suit the scale of the operation. There should be little or no requirement for heavy physical work. Passageways and access routes must allow efficient machinery operation. Time can be saved by feeding some animal types e.g. suckler cows, less rather than more frequently during the week.
- The farm layout must facilitate efficient movement of stock. Internal roadways are required in many cases. This is coupled with an appropriate number of paddocks and good fencing.
- Livestock handling facilities need to be functional and accessible. Fragmented farms or fields remote from the farmyard need to be serviced by a simple crush to treat or breed animals.

Management of livestock

- A clearly defined livestock system(s) cuts demand for labour especially where labour input can be predicted. Running less rather than more groups of stock has a dramatic effect on labour.
- Animal health deserves special attention. Use recognised animal husbandry practices like: ensuring calves get adequate colostrum, maintaining hygiene standards, vaccination, preventative treatments, adequate ventilation indoors or early turnout. Additional precautions should be taken if stock is bought-in.

Grassland management

- Consider using contractors for grassland management tasks that are predominantly mechanical. Fertiliser can be spread on most areas of the farm at once rather than after each grazing.

Management

- Maintain a tidy and organised farm office. Detailed physical and financial records are a highly important aid to good farm management. Use of a computer, internet/e-mail and mobile phones are invaluable labour saving tools for managing a business.
- Membership of a producer group to sell stock and buy farm inputs can have a significant saving on time.

- Efficient farmers continually review their current situation and planned developments. Setting goals including time management, are crucial to turn 'aspiration' into ' achievement'. Having 'goals' in writing serves as a constant reminder of what one wishes to achieve.
- Attending advisory events and participating in discussion groups is an important use of work time. Discussion groups have been found to be particularly effective in facilitating positive change (Byrne, 1997; Christie, 2002). Improving labour use is a topic that merits consideration especially as labour saving is a topical subject.

Teagasc has produced a booklet to assist farmers to focus on efficient use of work time. This booklet 'Take control of Your Time' is available from Teagasc offices nationally.

Relationship between work time and 'quality of life'

Work time has a considerable influence on 'quality of life' for farmers and their families. For instance, as many spouses are now working, time is required for family purposes during the 'working day' such as collecting children from school or other childhood activities. Care for the elderly is also an important social issue related to use of time. Excessively long work hours, can impact negatively on valuable social and family time.

Farm accidents and disability are other serious issues in farming. Securing health and safety can never be considered as a waste of time. Personal health, to some extent is a decision. Heavy manual work can lead to physical injuries and certain types of arthritis. A recent study of health and safety practices among farmers and other workers (Hope *et al.*, 1999) suggested that confusion between physical activity and aerobic activity has lead to a low participation rate in exercise outside work activities.

As farmer numbers decrease, there is potential for farmers to become isolated. The study of health and safety practices found that perceived loneliness is a greater source of stress among farmers than for other workers. The study also found that pressure of work is a source of stress for farmers, rural and urban workers. Clearly use of work time has social consequences and long working hours have the potential to cause isolation.

Conclusions

- A good 'benchmark' for labour use on drystock farms is the most efficient 25 % of farmers who achieve an average work time of 19 hours per livestock unit per year. Reaching or exceeding these should be the aim of every farmer.
- A considerable range of physical and organisational factors affect labour use on farms. Improving labour use commences by identifying where work time is being used. Devising approaches to reduce the labour requirement follows from this exercise. Examples of best practices can be found within the TGLS, while discussion groups have a lot to contribute where the experiences of other farmers regarding labour use are highlighted.
- In view of what the average industrial wage is and the relative availability of work outside the farm gate, profitability and return per hour worked on farm must be a key consideration when choosing to stay within the industry. With a rate of €10 per hour readily available for any type of work outside the farm gate, the average farmer earning €4.50 per hour is forgoing €5.50 for every hour spent on the farm.

- Use of work time impacts on quality of life. This along with income will influence the sustainability of drystock farming into the future.

Acknowledgement:

The authors would like to acknowledge the considerable assistance regarding TGLS data provided by Ms Hazel Leahy, Postgraduate Student, Teagasc Grange/UCD in preparing this paper.

References

Byrne, F.P. (1997). A study of the impact of modified New Zealand type discussion groups in technology transfer on Irish dairy farms. Unpublished M.Agr. Sc. Thesis, National University of Ireland, Dublin.

Christie, M. (2002). Discussion groups In: - *Teagasc opportunities and options for expansion*. Unpublished thesis submitted in partial fulfilment of the requirements for the degree of BA in education and training. NUI, Galway.

Hope, A., Kelleher, C., Holmes, L. and Hennessy, T. (1999). Health and safety practices among farmers and other workers: a needs assessment. *Occup. Med.* 49: 231-235

Leahy, H., O'Riordan, E.G. and Ruane, D.J. (2003a). Labour efficiency on suckler farms. In: *Teagasc discussion groups open day* Grange Research Centre, June 2003

Leahy, H., O'Riordan, E.G. and Ruane, D.J. (2003b). Counting the hours and making the hours count – A study of labour use efficiency on suckler farms. In: *Conference papers for Irish Farm Buildings Association Spring Conference*

Leahy, H., O'Riordan, E.G. and Ruane, D.J. (2003c). Working around the clock –spring calving on suckler farms. In: *Proceedings of Agricultural Research Forum 2003 p40.*

Ruane, D.J., Phelan, J., Darcy, A., Butler, T. and Hennessy, M. (1999). Labour use on Irish livestock farms. A study investigating current and future labour issues on farms in Tipperary South Riding. *Report Prepared by Rural Development Unit, Department of Agribusiness, Extension and Rural Development, UCD.*

Factors affecting finishing cattle performance

M.G. Keane

Teagasc, Grange Research Centre, Dunsany, Co. Meath.

Introduction

In recent years the costs of winter finishing have generally exceeded the value of the carcass gain. In the past, profitability depended on an autumn to spring price rise, which more recently it has been sustained by premia. With the likely decoupling of premia from production, the value of production must at least cover all direct costs (otherwise why produce), so if winter finishing is to be sustainable, costs of gain must decrease and/or the value of gain must increase. The main factors affecting the profitability of winter finishing are the cost of feed, the rate of gain and the value of gain. To some degree all are within the control of the producer.

Feed efficiency as affected by liveweight and rate of gain

The two major factors affecting the efficiency of feed utilization and hence the costs of gain, are animal weight and rate of gain. The theoretical feed requirements of animals of three liveweights (550, 650 and 750 kg) with two rates of gain (0.8 and 1.0 kg day^{-1}) are shown in Table 1. At a fixed rate of gain (e.g. 0.8 kg day^{-1}), feed requirements increase by about 15 % per 100 kg increase in liveweight. Thus, a 650 kg animal will require 15 % more feed to put on the same liveweight as a 550 kg animal. Once the animal is achieving a moderate level of gain it is quite efficient to further increase rate of gain. For example, a 550 kg steer gaining 0.8 kg day^{-1} requires 7.1 UFV day^{-1} (UFV = Unite Fourragere Viande = 1 kg barley), but for an input of an extra 0.5 UFV day^{-1}, liveweight gain is increased by 0.2 kg day^{-1} to 1.0 kg day^{-1}. Thus, there is an increase in liveweight gain of 25 % for an increased feed input of 7 %. More feed is required to put the same increment (0.2 kg) of gain on a heavy animal than on a lighter animal. For example, it requires 1.0 UFV day^{-1} to put 0.2 kg extra daily gain on a 750 kg animal already gaining 0.8 kg day^{-1} (i.e. twice as much as for the 550 kg animal). Still, even for the heavier animal, gain is increased by 25 % (0.8 to 1.0 kg day^{-1}) for a feed input increase of 11 % (1.0 UFV in 9.2 UFV day^{-1}). These data clearly indicate that feed requirements are least and efficiency is greatest when light animals are fed for high rates of gain, all else being equal.

Table 1. Theoretical energy requirements (UFV day^{-1}) of finishing steers by liveweight and daily gain

	Liveweight (kg)		
Daily gain (kg)	550	650	750
0.8	7.1 (100)	8.1 (114)	9.2 (130)
+ 0.2	0.5 (100)	0.7 (140)	1.0 (200)
Total 1.0	7.6 (100)	8.8 (116)	10.2 (134)

UFV = Unite Fourragere Viande = 1 kg barley (Jarrige, 1989)

Effects of feeding level on performance and carcass traits

As the effects of feeding level are well documented elsewhere they are only covered briefly here. The performance of finishing steers (mix of Charolais x Friesians and Belgian Blue x Friesians) fed on silage plus a range of concentrate levels from zero to *ad libitum* is shown in Tables 2 and 3. The silage analysis was (g kg^{-1}): dry matter (DM) 210, DM digestibility 758, and pH 3.7. The concentrate formulation was (g kg^{-1}): rolled barley 870, molasses 47.5, soyabean meal 67.5, and minerals/vitamins 15. The feeding period was 132 days.

As concentrate level increased, silage intake decreased at an increasing substitution rate (Table 2). For the first 3 kg day^{-1} increment of concentrate DM, silage DM intake decreased by 0.30 kg kg^{-1} concentrates, so total DM intake increased by 0.70 kg kg^{-1} concentrates. From low to high concentrates (i.e. from 3 to 6 kg day^{-1} DM approx.), the decrease in silage intake was 0.68 kg kg^{-1} concentrates, so the increase in total DM intake was only 0.32 kg kg^{-1} concentrates. Obviously the response to the second 3 kg day^{-1} concentrate increment was less than to the first, because the effect on total DM intake was less. Going from high to *ad libitum* concentrates (i.e. the 3rd 3 kg day^{-1} concentrate DM increment approx.) resulted in a reduction in silage DM intake greater than the increased concentrate DM intake (1.10 kg silage kg^{-1} concentrates). As a result, total intake was reduced by about 0.1 kg silage DM per kg increase in concentrate DM intake. In summary, the substitution rate of concentrates for silage increased with increasing concentrate level. Maximum DM intake occurred when the ration was about 60 % concentrates and 40 % silage but maximum net energy intake occurred with *ad libitum* concentrate feeding.

Table 2. Performance of finishing steers by supplementary concentrate level

	Silage only	Silage + low conc.	Silage + high conc.	Conc. *Ad Lib.*	Mean[1]
Intakes (kg DM day^{-1})					
Silage	7.6	6.7	4.8	1.6	4.4
Concentrates		3.0	5.8	8.7	5.8
Total	7.6	9.7	10.6	10.3	10.2
UFV intake[2]	6.1	8.7	10.2	10.9	9.9
Daily gains (g)					
Liveweight	0.34	0.86	1.01	1.13	1.00
Carcass	0.25	0.58	0.70	0.82	0.70
Carcass as % LW	74	67	69	73	70

[1]Excluding silage only treatment; [2]Values of 0.8 for silage and 1.1 for concentrates.

Liveweight gain on silage only was 0.34 kg day^{-1}. This seems to be underestimated as carcass gain was 0.25 kg day^{-1} and generally at low levels of performance, carcass gain is only 55 % to 60 % of liveweight gain (it was 74 % here). Thus, a more realistic value for liveweight gain is 0.42 kg day^{-1}. The response to the first concentrate increment was 147 g liveweight (assuming 0.42 kg day^{-1} on silage only) or 110 g carcass weight per kg. For the 2nd concentrate increment, the response was 54 g liveweight or 41 g carcass weight and for the final concentrate increment the response was 39 g liveweight and 43 g carcass weight.

Slaughter weight and carcass weight (Table 3) reflect the liveweight and carcass weight gains. Kill-out increased and conformation improved with increasing level of concentrates. Fat class increased with increasing concentrate level up to the high concentrate level but not thereafter. If kidney plus channel fat (scaled for carcass weight) is used as an indicator of fatness, then there was no increase in fatness above the low concentrate level. This is in agreement with earlier findings showing that substitution of concentrates for silage either decreased or had no effect on fatness even though carcass weight was increased.

Table 3. Slaughter traits of finishing steers by supplementary concentrate level

	Silage only	Silage + low conc.	Silage + high conc.	Conc. *Ad Lib.*	Mean[1]
Slaughter weight (kg)	583	653	673	687	671
Carcass weight (kg)	308	352	367	382	367
Kill-out (g kg^{-1})	528	539	545	557	547
Conformation class	2.11	2.64	2.75	2.83	2.74
Fat class	2.17	3.39	3.64	3.60	3.54
Kidney + channel fat (g kg^{-1})[2]	24.6	33.1	35.3	32.1	33.5

[1]Excluding silage only treatment as not commercially relevant; [2]Of carcass.

Duration of finishing

It is often assumed that the rate of daily gain is constant over the whole finishing period. This is not so. At the start of the finishing period daily gain increases somewhat initially, but after a relatively short period of time it starts to decrease and continues to decrease with increasing length of finishing period. An example of this is shown in Table 4. In two experimental treatments, finishing cattle were fed either silage only or silage plus 6 kg day^{-1} supplementary concentrates for 147 days. Mean daily gains were satisfactory at 0.65 and 1.10 kg day^{-1} for silage only and silage plus concentrates, respectively. However, these means were comprised of gains, which were higher in the early part of the finishing period and lower towards the end. For silage only, daily gain in the first 8 weeks was 0.80 kg but it was only 0.54 kg over the final 7 weeks. The corresponding values were 1.43 and 0.79 kg for silage plus concentrates.

Table 4. Daily gain (kg) by finishing interval

Interval (d)	Silage	+ 6 kg Conc.
0 - 147	**0.65**	**1.10**
0 - 56	0.80	1.43
56 - 98	0.59	1.02
98 - 147	0.54	0.79

The proportional fall in daily gain was greater for the higher feeding level because the animals were further advanced on the growth curve on any particular date. As the rate of gain on a fixed feeding level declines with increasing length of finishing, clearly therefore, the mean daily gain over a finishing period depends on its duration. In the example in

Table 4, if the animals had been slaughtered after 98 days rather than after 147 days, mean daily gains would have been 0.71 and 1.25 kg day^{-1} for silage and silage plus concentrates, respectively rather than 0.65 and 1.10 kg day^{-1}. These data indicate that daily gain declined by about 0.020 and 0.045 kg day^{-1} per week of finishing for silage only and silage plus concentrates, respectively. There are many reasons why rate of gain decreases during finishing. They include an increase in gut contents in the early stages, static intake, and increased fat (energy) content of the gain. Deposition of a fixed energy increment results in decreased weight gain as the energy content of the gain increases.

Effects of level of feeding and duration of finishing

Earlier the effects of feeding level on animal performance were described for an experiment in which the feeding treatments were all applied for a constant period of time. Consequently, slaughter weight differed greatly between treatments. It could be argued that this approach is not valid, and the objective should be to take animals to a constant carcass weight (or perhaps constant level of fatness). If this were done the animals on the higher feeding levels would require shorter finishing periods and/or those on the lower feeding levels would require longer finishing periods. Since daily gain is affected by duration of the finishing period, the performance values shown for the fixed finished period would be different for feeding periods of varying duration. It would be expected that the mean daily gains on the higher feeding levels would increase (due to the shorter finishing period) and those on the lower feeding levels would decrease (due to longer finishing).

To ascertain the effects of finishing period at varying supplementary concentrate levels an experiment similar to that described above was carried out with two slaughter dates (105 and 174 days). The silage was of poorer quality than that used earlier and when fed alone supported gains of little more than half those recorded earlier (i.e. 0.23 - 0.24 kg day^{-1}). The performance data (Table 5) show that the decrease in performance with time was greater at the higher feeding levels. On silage only, there was no decline (from 105 to 174 days compared with earlier) in liveweight gain with time. For the low concentrates, the liveweight gain decline was 0.2 kg day^{-1}, for the high concentrates it was 0.4 kg day-1, and for the concentrates *ad libitum* it was 0.5 kg day^{-1}. This trend would be expected in that by 105 days, the animals on the higher feeding levels were at a more advanced stage of maturity than those on the lower feeding levels.

The decreases in carcass gain were much less, relatively, than the decreases in liveweight gain. There was no reduction in carcass gain after 105 days on silage only and neither was there any reduction on low concentrates. On high concentrates, carcass gain decreased by 0.22 kg day^{-1} while on concentrates *ad libitum* the decrease was similar at 0.16 kg day^{-1}. While the relationship between liveweight and carcass weight gains before and after 105 days did not follow a consistent pattern, it is clear that the decline in carcass weight gain with time was proportionately less than the decline in liveweight gain. Averaged over the three concentrate treatments (i.e. the commercially relevant feeding levels) mean liveweight gain was 0.37 kg (32 %) lower in the period after 105 days than earlier. The corresponding decline in carcass weight gain was 0.13 kg (20 %).

Table 5. Performance of finishing steers by feeding level and period

	Silage only	Silage + low conc.	Silage + high conc.	Conc. *Ad Lib.*	Mean[1]
Liveweight gain (kg day^{-1})					
Start to 105 days	0.23	0.98	1.17	1.35	1.17
105 to 174 days	0.24	0.78	0.77	0.86	0.80
Carcass gain (kg day^{-1})					
Start to 105 days	0.12	0.52	0.67	0.79	0.66
105 to 174 days	0.14	0.52	0.45	0.63	0.53
Carcass as % of liveweight gain					
Start to 105 days	54.2	52.4	57.2	58.7	56.1
105 to 174 days	56.6	67.2	57.9	73.7	66.3

[1]Excluding silage only treatment as not commercially relevant.

Slaughter weight ranged from 496 to 613 kg at 105 days and from 513 to 651 kg at 174 days (Table 6). Corresponding carcass weight ranges were 251 to 329 kg, and 264 to 361 kg. Kill-out ranged from 506 to 523 g/kg at 105 days and from 514 to 543 g/kg at 174 days.

Table 6. Slaughter traits of finishing steers after two finishing periods

	Silage only	Silage + low conc.	Silage + high conc.	Conc. *Ad Lib.*	Mean[1]
Slaughter weight (kg)					
After 105 days	496	573	599	613	595
After 174 days	513	634	653	665	651
Carcass weight (kg)					
After 105 days	251	291	311	329	310
After 174 days	264	334	346	361	347
Kill-out (g/kg)					
After 105 days	506	508	518	523	516
After 174 days	514	527	530	543	533

[1]Excluding silage only treatment as not commercially relevant.

Effects of diet mixing on finishing performance

Feed mixer wagons are now commonplace on cattle farms. They have many advantages, but it is unclear if mixing as compared with separate feeding of the same feeds improves performance. To examine this finishing steers (mix of Charolais x Friesians and Belgian Blue x Friesians) were fed silage plus concentrates separately or by mixer wagon. Two levels of concentrates were used, namely 3 and 6 kg DM day^{-1}. The mix was adjusted weekly to ensure that those fed the mixed diet consumed the same quantity of concentrates as those fed the ingredients separately. The duration of the finishing period was 132 days and 72 animals (18 per treatment) were used. The rationale for examining the effects of mixing at two concentrate levels was the possibility that there may be an effect at the high but not at the low concentrate level. This could arise if the higher level of concentrates tended to cause digestive upsets when fed separately. The concentrates were fed once daily to the separate treatment groups.

Mean daily concentrate intakes were 3.0 and 5.8 kg, and were the same (as intended) for the separate and mixed feeding treatments. The animals fed the mixed ration consumed 0.3 to 0.4 kg day^{-1} more silage and consequently more total DM. This difference, while statistically significant was small in practical terms. Liveweight and carcass weight gains were higher for the high concentrate level but there was no effect of mixing at either concentrate level (Table 7). There was an effect of concentrate level on all slaughter variables except conformation, but there was no effect of mixing on any variable. It is concluded that mixing of silage and concentrates had no effect on any parameter of performance or carcass traits compared to separate feeding of the same ingredients.

Table 7. Diet mixing and performance of steers

Concentrates	Low		High	
Method[1]	S	M	S	M
Liveweight gain (g day^{-1})	862	860	1022	1002
Carcass gain (g day^{-1})	585	576	711	678
Slaughter weight (kg)	653	652	674	671
Carcass weight (kg)	352	351	369	364
Kill-out (g kg^{-1})	539	538	547	543
Conformation	2.6	2.7	2.7	2.8
Fat score	3.4	3.3	3.6	3.7
Kidney + channel fat[2]	36	36	37	39

[1]S = Silage and concentrates fed separately, M = Total Mixed Ration; [2]g kg^{-1} carcass.

Pattern of concentrate supplementation

With the advent of premia payable at a fixed age rather than weight, and stipulated retention times, flat rate feeding of concentrates was too inflexible and could lead to animals being under finished or over fat. Accordingly, more flexible approaches were examined. The most extreme of these involved delaying the introduction of concentrates for about 2 months, then building up gradually to maximum intake, and thereafter offering concentrates *ad libitum* to slaughter. This was designated ADLB as opposed to the standard flat rate approach which was designated FLAT. A summary of all the data for the FLAT and ADLB comparisons is shown in Table 8. On average, the ADLB animals consumed more concentrates and less silage. Due to their slightly higher concentrate intake, liveweight and carcass weight gains were slightly higher for the ADLB group, and efficiency of energy utilization was slightly better. The small differences in slaughter weight and carcass weight were due to the difference in gain.

Some producer/processor schemes require that animals be fed on a high concentrate diet for two to three months before slaughter and that fat colour is white rather than yellow. The ADLB approach should meet the requirements of these schemes without any increase in the total concentrate input in the finishing period.

Table 8. Performance of steers fed Flat or ADLB patterns

	FLAT	ADLB
Silage	5.14	4.66
Concentrates	4.49	5.02
Slaughter weight (kg)	664	670
Carcass weight (kg)	346	352
Kill-out (g kg^{-1})	523	525
Conformation	2.59	2.70
Fatness	3.97	3.63
Kidney + channel fat (g kg^{-1})[1]	50.1	42.7

[1]Of carcass.

Delayed introduction of concentrates

Sometimes winter-finished animals may not be targeted for sale until late spring, or a heavier carcass is desired than that which results from a normal finishing period. Alternatively, it may be desirable to finish animals quickly, ensuring that level of fatness is acceptable at lighter carcass weights. Both these alternatives were explored. Finishing steers (mix of Friesians and Charolais x Friesians) were offered: (1) silage plus a flat rate of 6 kg concentrates per head daily (after a 3 weeks adjustment period) for 154 days, (2) concentrates *ad libitum* (after a 4 weeks adjustment period) to slaughter after 104 days, and (3) silage only for 112 days followed by concentrates *ad libitum* (after a 3 weeks adjustment period) to slaughter after 196 days. The objective was that all groups would receive the same total concentrate allowance and this was achieved. Silage intake increased with increasing length of finishing period. Performance data are shown in Table 9. Performance on silage only (for those that received silage only for 112 days) was quite good at 0.5 kg day^{-1}. The performance of the group fed silage plus a flat rate of concentrates was also quite good at about 1.0 kg day^{-1}. The performance of the group fed concentrates *ad libitum* from the beginning was about 1.25 kg day^{-1}.

When concentrates were offered *ad libitum* to animals, which had received silage only for the previous 112 days, they gained about 1.5 kg day^{-1} or about 0.25 kg day^{-1} more than those offered concentrates from the beginning. There was no difference in mean daily liveweight or carcass gains between the flat rate group and the delayed introduction group. Efficiency of energy utilization was best for the group offered concentrates *ad libitum* from the start, but interestingly, and contrary to expectation, efficiency was better for the group in which concentrate introduction was delayed than for the flat rate group.

Table 9. Performance of steers finished on different feeding patterns

	Flat rate	Conc. Day 0	Conc. Day 112
Days 0 to slaughter	0.98	1.24	0.95
On *ad libitum* concentrates[1]	-	1.24	1.48
Slaughter weight (kg)	634	623	668
Carcass weight (kg)	328	323	353
Kill-out (g kg^{-1})	518	527	527
Conformation	2.17	2.33	2.50
Fatness	3.70	4.13	4.13
Kidney + channel fat (g kg^{-1})[2]	48.7	37.1	42.2

[1]Including the introductory period; [2]Of carcass.

Slaughter traits reflected growth rates. Kill-out was similar for the two *ad libitum* concentrate finished groups and higher than for the flat rate group. Conformation was better for the two *ad libitum* concentrate finished groups - particularly the delayed introduction group, probably because of the greater carcass weight. Fat score was higher for the two *ad libitum* concentrate finished groups but kidney plus channel fat scaled for carcass weight was lower. The results show that the maximum potential finishing gain of 18 - 19 month old steers which have had good performance at pasture the previous season is about 1.25 kg day^{-1}. Delaying concentrate introduction for 112 days increased performance on *ad libitum* concentrates by about 0.25 kg day^{-1} or about 16 g day^{-1} per week delay in concentrate introduction. This higher performance was due in part to higher intake.

Conclusions

- Efficiency is highest when light cattle are fed for a high rate of gain.
- Response to concentrates declines with increasing concentrate level.
- Performance declines with increasing length of finishing period.
- There was no advantage to mixing silage and concentrates.
- Programmed feeding can aid management, fatness and colour.
- Performance is a function of animal potential.
- Delayed concentrate introduction increases sale weight.

Brazil - The world's food producing giant

John Shirley

Irish Farmers' Journal

Introduction

Food producers of the old world of Europe are under threat from the new world of South America. Products that are immediately vulnerable include; -

- Beef
- Pork
- Poultry
- Sugar

Longer term, milk and sheep products also look vulnerable.

Focussing on beef, both in terms of export and home markets, Irish beef is increasingly in competition with South American beef, in particular Brazilian beef. Key output figures from South America are outlined in Table 1.

Table 1. Area, human and cattle statistics. Ireland compared with South America and the USA.

	Area (M/ha)	Human Pop^n (Million)	Cattle herd (Million/hd)	Cattle Slaughter Million	Exports Tonnes	Kill rate per 100
Brazil	855	176	167	40	890,000	24%
Argentina	279.1	36.6	49	13	300,000	26%
Uruguay	17.6	3.36	11.1	1.6	200,000	15%
USA	916	288	96	35	1,061,000	36%
Ireland	7	3.8	7 1	1.78	450,000	29%

This shows that Brazil dominates South America in terms of land area, herd size and is fast overtaking the US as the world's biggest beef exporter.

More facts on Brazil

- At 167 million, its cattle herd is double that of the EU.
- Beef exports from Brazil have doubled in the past 5 years.
- If stocked at the same rate as Ireland, Brazil could carry four times as many cattle
- Brazil is on the same latitude as India, which has 7.3 times the human population.

Overall South America is a vast area with fertile land, adequate rainfall, thinly populated, large farms, very low costs and huge food production potential. Of the three countries, Brazil, Argentina and Uruguay, Brazil would seem to have the growing ambition, organisation and political will to exploit this potential. Indeed the process is already underway in that in the past decade;

- Pork exports have grown from 100,000 to 500,000 tonnes.
- Beef exports have grown from 400,000 to 900,000 tonnes.
- Poultry exports have grown from 500,000 to 1,600,000 tonnes.

Timing and coincidences

A number of developments have coincided to increase the threat from Brazilian beef;

- New technology giving 5 months shelf life for South American beef. This allows chilled product to compete in the higher priced EU fresh beef market.
- Sharply reduced shipping costs. Chilled product is transported from Brazil to the UK for 12 c/kg (4.8p/lb).
- An effective new Government in Brazil that has stabilised the economy, bringing down inflation to less than 10% and interest rates to below 20%.
- Ambitious plans to reduce the slaughter age and increase carcase weight
- Flat rate tariffs on boneless chilled beef, which facilitate entry into the EU of high quality beef cuts paying full tariffs.
- New WTO talks where South America will look for freer entry into EU and other markets.

Already the list of export destinations for Brazilian beef reads like Ireland's beef outlets ten years ago; Egypt, Iran, Israel, Algeria. In 2002 Brazil plans to export 200,000 tonnes of beef to Russia twice the Irish level.

Brazilian strengths

- Grassland, because of its tropical climate has the capacity to produce double the dry matter output of the best Irish grassland.
- Huge units of up to 200,000 suckler cows in a herd. 1,000 plus herds are common
- Good research and the adoption of irrigation, grass reseeding, fertilisation and rotational grazing technologies. This is based on 100 ha irrigation circles and one day paddocks using electric fencing.
- Zebu cattle, which can match a good continental animal in Ireland for growth.
- An average cattle slaughter age that is falling rapidly.
- Farmers who were selling beef last April at €1/kg carcase weight (36 p/lb) and still making a profit. This has since increased to 116 c/kg (41.4 p/lb).
- Huge tracts of maize and soya bean meal that, are the basis of major pork and poultry industries and now beef feedlots are starting up as well.
- Beef slaughter plants that can compete with anywhere in the world for hygiene and cleanliness. Otherwise chilled beef cuts with a guaranteed five-month shelf life would not be feasible.
- Provinces, which are free of FMD without vaccination, provinces that are free of FMD with vaccination, and provinces of indeterminate status. The latter are around the Amazon basin and do not carry many cattle.
- Laws to deter the cutting down of the rain forests even if it is not always possible to

police them.

- Extremely cheap labour. The minimum wage is about €60 per month, which is shortly to be increased by 20%. In practice, factory floor wages are reckoned to be about €120 a month.

Brazilian deficits

- Fears that the raging inflation that went as high as 2000% in 1993 could return. In 1999 1 Brazilian Real approximately equalled a US Dollar. Last April the exchange rate was 3.4 Real to buy a Dollar. Today the Real has hardened to 3/$.
- A reputation of producing tough beef, due to the breeds of cattle and the age at slaughter.
- Huge tracts of the country are badly served with roads. It can often cost as much to get the beef from the slaughter point to the port, as it costs from the port to Europe.
- A 7% VAT and rural fund tax which the beef plants collect from cattle slaughtering.
- Constant fears of FMD - since the disease is poorly policed in some of its 13 neighbouring countries.
- Grassland, which is based on C4 grasses (like maize plants). These are less digestible than the C3 temperate grassland varieties in Ireland *et al.*
- A climate that is mostly too hot for the British and European beef breeds.
- An inequitable society with a class of huge landowners, many of whom live and work in the cities, while gauchos herd the cattle for little more than food and lodging.
- While the Government has committed Brazilian farmers to cattle tagging this may be a long time coming.
- Hormones are discouraged but probably still used.

Brazilian production costs

With no accommodation costs and little winter-feed involved, experts compute the cost of producing a live kg of beef at between 30 and 40 c/kq depending on fertiliser use and supplementary feeding. A similar all in figure for the best farms in Ireland is 125 to 140 c/kg.

Poor facilities in Brazilian meat plants - a myth?

As far as hygiene is concerned, some of the Brazilian meat plants are way ahead of most plants in Europe. They have to be. They are exporting chilled beef to Europe, with a four-month shelf life. Cattle are brought into lairages the day before slaughter to allow gut contents to empty out. As they go up the line for slaughter, they are washed, and the hindgut is tied and sealed on the line. Visitors to these plants change all clothes and wash hands and boots when changing from factory floor to floor.

Factories pay for cattle 35 to 45 days post slaughter, or else pay in the first week at a significant discount. Some plants still buy cattle on liveweight rather than the carcase weight.

Table 2. Share out of EU 'Hilton' tariff free quota into the EU July 1, 2002 to June 30, 2003.

Country	Tonnes
Argentina	38,000
USA	11,500
Australia	7,000
Uruguay	6,300
Brazil	5,000
Paraguay	1,000
New Zealand	300

Shipping your steak from Brazil for 5 cent

- A 40 ft container carrying 25 tonnes of frozen beef can be shipped from Santos in Brazil to Tilbury in England for about $2950 or $118 a tonne or 11.8 US cents a kg.
- The same container filled with chilled beef will only cost an extra $200. The chilled beef cannot be filled as closely so that the weight may be reduced to about 23 tonnes. This works out at about $137 a tonne or 13.7 US cents a kg. Translated back to the steak on your plate this is less than 5 cent.

Traceability

Cattle are followed through in large batches and by day of slaughter. Farm units are so large that most farmers will sell at least 100 cattle at any one time. These 100 cattle are treated as a batch, and travel through the slaughter and boning halls in that single batch. This batch is bar coded and the beef traceable on that bar code. Since July, farms selling cattle have to tag animals at least 40 days pre slaughter.

Tariffs on EU beef imports

Table 3. Tariffs on EU beef imports

Carcase	1,738 euro/tonne + 12.8%*
Boneless fresh/chilled	3,034 euro/tonne + 12.8%*
Boneless frozen	2,211 euro/tonne + 12.8%*

*Of declared import price.

Boneless striploin beef is available FOB in Brazil at €3,636/tonne. Add transport costs of about €135/tonne and include tariffs; the cost of Brazilian striploins landed in Ireland is approximately €7,260/tonne or €7.26/kg. This is still €2/kg less than the wholesale price of best quality Irish striploin beef on the Irish market in the summer of 2003. Last April before Brazilian prices improved, the gap was €4/kg.

Lula's Success

Luis Ignatio Lula Da Silva is a former communist leader, and is now President of Brazil. He has huge public support for a three-pronged fiscal reform. These are; -

- Giving autonomy to the central bank in Brazil to control currency matters (already achieved).
- Reform of the costly public pension system, and removal of civil servant privileges – this legislation recently enacted.
- Simplification of tax code from 45 to 8 different taxes.

The upshot of the president's economic success and promise of stability is an upsurge of interest in investment in Brazil from at home and abroad.

Latest news from Brazil

- Land and property prices rocketing in settled Brazil - $2,000 a hectare.
- Breakthrough in pre-packing beef for supermarkets in Sweden going well – 800g packs (four containers shipped in the first two months of this business).
- Two phenomenal years for soya and sugar cane.
- Land for sugar cane is now paying for itself in one year – industry now de-regulated.
- Ex minister for Agriculture taken over as head of beef - great contacts and professionalism.
- Interest rate down by 2.5% to about 22% inter bank rate.
- April FOB strips $2,350 to $2,500 a tonne. August $4,000/tonne.
- FQ boneless $1,300/$1,400 a tonne in August, $1,100 in April.
- New legislation for export factories. From July 15 all cattle to be tagged or chipped, and held on farm for 40 days pre sale.
- Irish companies have a very high proportion of the GATT licences.
- According to Brazilian sources, the two biggest importers in recent months have been Fair Oak Foods and QK/Dawn Meats.

Conclusions

- Ireland cannot compete with Brazil on commodity beef.
- Irish farmers must target the EU beef customers that are paying premium prices based on 52-week delivery of consistent young beef reared on grass and finished on meals. South America is less likely to compete in this market.
- Commissioner Fischler has offered an average cut in import tariffs on the WTO round with less on sensitive products like beef. The Irish beef market cannot absorb any further tariff cuts. An absolute ceiling on South American beef imports into the EU is needed. Mr Fischler has hinted at this.
- A big investment lies in producing the suckler calf. In light of total decoupling of premiums the best prospect for Irish beef farmers lies in keeping cows cheaply on long grazing seasons with intensive early finishing of progeny.

Cattle farming after Fischler

Bernard Smyth

Chief Beef Adviser, Teagasc, Grange

Introduction

In considering the impact of the Fischler changes to the CAP, the most recent data on cattle farm incomes from the National Farm Survey and from Teagasc Drystock Monitor Farms for 2002 has been examined. This facilitates the examination of income levels on cattle farms and more importantly the components of income and the differences between the top and bottom farms on the basis of technical efficiency. Gross margin per hectare excluding premium is an excellent financial measure of technical efficiency and will be a very important figure in determining farm income post Fischler and decoupling.

Fischler assumptions

It is assumed that from 2005, the total decoupling of premia from animals will be the decision taken in Ireland. This will provide freedom to farm without the existing premia rules of retention dates, age eligibilities for application and operating at a particular stocking rate to maximise extensification payments. Production systems after Fischler will therefore have to be financially efficient, and will need to produce a gross margin excluding premium to justify their existence. If a system cannot generate a margin over feed, veterinary and marketing costs, then it is making no contribution to farm overhead fixed costs and will be eroding the single farm payment even before the deduction of fixed costs from the single farm payment. Production systems that will prosper post Fischler will be generating a high gross margin and this will be achieved by high levels of technical efficiency combined with selling into premium EU markets at premium prices. Beef price in Ireland compared with mainland EU beef price and animal transport regulations will determine whether animals are exported live or as carcass beef. Cross compliance issues that will require land to be kept in a good agricultural condition will encourage farmers to stay farming and should be compatible with efficient Irish cattle farming.

Cattle farm incomes 2002

The national farm survey for 2002 shows that 51% of Irish farms have cattle as the main enterprise, and they farm on average 27 ha generating on average €322 family farm income per ha. The larger cattle farms that require at least 0.75 labour unit account for 8% of Irish farms, farm 56 ha and earn an average €390 per ha. Premia account for over 100% of family farm income on cattle farms.

Table 1 looks at gross margin per livestock unit excluding premium for two cattle systems on soil group 2 from the 2002 national farm survey for the bottom 25%, middle 50% and top 25% of farmers.

Table 1. Gross margin per Livestock Unit (excluding premium)

System (No Farms)	Bottom 25%	Middle 50%	Top 25%
Single suckling (195)	€62	€106	€223
Mixed production (173)	€22	€116	€287

Source: - National Farm Survey 2002 - Comparative Analysis (Gerry Quinlan)

With full decoupling many of the farms in the bottom 25% will need to modify their production system and/or improve efficiency in order to produce a positive gross margin.

Table 2 examines gross margin excluding premium per hectare for Teagasc Monitor Farms (plus other farms with drystock profit monitor completed for 2002). This table looks at farms by system and groups by top third, average or bottom third.

Table 2. Gross margin - € /ha (excluding premium)

	Suckling (56)	Non Suckling (42)
Top 1/3	€490	€366
Average	€301	€107
Bottom 1/3	€89	-€134

Source: - Teagasc Drystock Profit Monitor Analysis 2002 - Monitor Farms

Farms at suckling have on average a much higher gross margin excluding premium than farms buying weanlings or stores for finishing - €301 per ha compared with €107 per ha respectively. In addition the top third at suckling are much better than the top third without suckler cows - €490 per ha compared with €366 per ha. Even the bottom third at suckling are achieving about €100 per ha while the bottom third without sucklers are in negative gross margin excluding premium. Table 2 tells us that suckling is a more secure system and has a higher potential gross margin pre Fischler. This would be especially true for suckling system selling weanlings or stores before claiming male special beef premium.

With full decoupling post Fischler, male animals will not have the high premia potential value attached and would be expected to reduce in value somewhat, but this could be offset to some extent by an increase in value of heifers. On balance this is likely to reduce the potential gross margin excluding premium for suckling, which can only be offset at farm level through efficiency improvements with existing cow numbers or adding the few extra cows that will be allowed with the removal of premia stocking rate restrictions.

For non-suckling systems a somewhat reduced raw material price for male animals post decoupling should improve potential to increase gross margin excluding premium. However, there is a need for an increased beef price plus efficiency improvements if all efficient farms at this system are to achieve a worthwhile gross margin excluding premium. Table 3 compares suckling and non-suckling farms in more detail looking at output, costs and premia per hectare.

Table 3. Summary - Drystock Profit Monitor Analysis by system - 2002

	Suckling (56)	Non Suckling (42)
Farm size (Adj. ha)	59	53
Stocking rate (LU/ha)	1.91	1.62
Output Excl Pr/ha	€745	€552
Variable costs/ha	€444	€442
Gross margin (excl pr)	€301	€107
Premia/ha	€693	€782
Fixed costs/ha	€455	€424
Profit/ha	€539	€464
Premia retained as profit (%)	81%	61%

Source: - Teagasc Drystock Profit Monitor Analysis 2002 - Monitor Farms

Premia retained as profit is lower on non-suckling farms, as some of the potential premia receipts are bid into the male animals at purchase. Stocking rate on the non-suckling farms is significantly lower than suckling farms and has significant potential for increase once premia stocking rate restrictions are removed post Fischler.

Options post Decoupling

With premia retention as profit only amounting to 60 - 80 % on efficiently run monitor farms, the first question post decoupling is whether to keep cattle at all, or de-stock and collect the single farm payment? Total de-stocking will allow for significant reduction in variable costs and the possible elimination of total variable costs if it were not for cross compliance costs. Without cattle, fixed cost savings will only be possible with machinery running and interest costs, and overall savings in fixed costs with de-stocking will be small. The single farm payment post decoupling will suffer a reduction due to the deduction for national reserve and modulation cut, plus a further possible cut if the sum of individual entitlements exceed the national quota - in total this could amount to a cut of 8 - 10%.

Table 4. Profit post Fischler with no cattle on 50 ha (based on Drystock Profit Monitor Analysis for 2002)

	Monitor Farms 2002	With no production post Fischler
Output from production	€33,500	€0
Premia	€36,500	€33,000
Output including Pr	€70,000	€33,000
Variable costs	€22,500	€5,000
Fixed costs	€22,500	€12,500
Profit	€25,000	€15,500

Despite significant savings in variable costs and fixed cost savings, ceasing production will result in a major fall in farm profit as can be seen in table 4.

How extensively should you farm?

Cattle farms with the highest stocking rate pre Fischler, did not always enjoy the highest income per ha as additional premia as extensification made more extensive systems more profitable in some situations. However within the more efficient farms (as shown by Teagasc Monitor Farms) the top third achieved €18,000 more profit on 50 ha compared with bottom third - see table 5.

Table 5. Farm profit and stocking rate pre Fischler (based on Drystock Profit Monitor Analysis 2002

	Data for 50 ha Farm	
	Top 1/3	**Bottom 1/3**
Stocking rate (LU)	102	75
kg Beef liveweight produced	33,300	23,500
Value of output	€45,750	€20,550
Value of extra output on Top 1/3	€25,200	
Less premia on Top 1/3	-€3,500	
Extra costs on Top 1/3	-€3,650	
Extra profit on Top 1/3	€18,050	

The extra profit for the top third was achieved due to better stocking rate and animal performance resulting in higher beef output per ha combined with a better selling price due to better quality.

Production System

Tables 2 and 3 demonstrated that non breeding systems were achieving a lower gross margin excluding premium, and unless price differentials between stores and beef change significantly many non breeding farms will have to consider starting a breeding herd to supply at least some of the raw material for beef production. Systems finishing animals in the Spring after an expensive indoor winter had the benefit of a 21 month special beef premium (and possible extensification premium) to subsidise the finishing winter up to now, and this helped to ensure supplies of beef in the first 6 months of the year. Post decoupling, systems with high cost winter feeding will only be justified with a price premium for out of season production - greater seasonality of beef supply is likely post Fischler. Poorer quality animals are likely to depend on 3rd country markets and commodity beef prices which will be less attractive - this could see a greater price differential between high yielding well conformed animals suited to best EU markets and poorer quality beef animals.

Increases in the scale of operation will be possible for some individuals post Fischler, and this will present the possibility of increased profit through increased stocking rate and/or greater spreading of fixed costs. With decoupling the 1.4 and 1.8 LU/ha stocking rate ceilings will be removed as well as the 180 head limit for special beef premium. Farms with low stocking rates or with no cattle could possibly take cattle in for grazing in order to ensure their land is kept in a good agricultural condition - this could provide cheap feeding for other cattle farmers with cattle.

Conclusions

Since most of the fixed costs and some variable costs will remain on farms that de-stock, there will not be an incentive to abandon production post decoupling. The incentive to farm will be to generate a positive gross margin excluding premium, which will make a contribution to covering all; or part of fixed costs, thereby safeguarding the maximum amount of the single farm payment as profit. Some cattle farms in the bottom 25% will change systems and improve efficiency while some will exit production. Technically efficient farms in the top 25% achieving a good gross margin excluding premium will intensify and expand.

It will be essential to exploit premium markets, combined with production and marketing efficiency through more partnership involvement with farmers and beef processors. Seasonality issues will have to be resolved through partnerships. Breeders and finishers of quality beef animals will have to be rewarded with improved prices and a closing of the gap between Irish and EU beef prices. The price differential between weanlings/stores and beef will determine whether animals are finished in Ireland or exported live. Detailed and ongoing financial analysis will remain important for all cattle farms to help identify strengths and weaknesses of the business.

Obtaining the maximum contribution from grazed grass will help dilute unit cost of production and is our greatest asset on Irish cattle farms. Based on performance on monitor farms in 2002, many technically efficient farms have a target gross margin excluding premium of up to €500/ha to aim for. With the lifting of some restrictions on stocking rate post Fischler this target can be further increased on good farms in the future.

Report on Irish Grassland Association Study Tour to New Zealand 2003

i) Best New Zealand Farming Practices – Finance

Michael Brady, Michael Kelly, Bryan Daniels and Noel Bowen

Financial/future planning/goal setting

The entire management of the farm business (both financial & physical) is focused on increasing net worth. There exists a concept of 'backward budgeting' i.e. a % return on capital of 15% is targeted, and management decisions are influenced accordingly. Farm business can grow by: -

- Maximising economic farm surplus (net profit);
- Capital appreciation.

There is a career structure in dairy farming, which drives the farmer to increase his equity, and focuses on business goals, e.g.

- Education,
- Contract milker,
- Share milker,
- Farm owner and/or equity partner,
- Business owner,
- Retire.

The following factors have greatly increased net worth (equity):

- Increased capital appreciation of land and milk shares in recent years has enabled leverage of farm business assets to fund new farms or off farm investments.
- Farmers are very mobile in the pursuit of increased net worth. They are prepared to move home 3 - 4 times in a lifetime.
- Farmers are prepared to upskill e.g. "strategic planning".
- There is an ability to focus on the 'bigger picture' rather than focusing on excellence in one area of interest or importance.
- KISS principle (Keep it stupidly simple) drives the NZ attitude.

'Ultimately the business direction must head toward your life goals'.

Budgeting/monitoring/analysis

A financial budget is the basis of ensuring financial goals are achieved. A budget is done 'on farm' and monitored monthly by a programme called Cashmanger. Consultants encourage farmer to do the budget themselves, so as to ensure ownership of the budget plan. If a farm is over budget, the concept is to 'take it from some place else'.

It is suggested, "farmers are bad profit takers". There are KPI (Key Performance Indicators), which are monitored regularly. Throughout the year the bank is presented with the "budget V actual" reports to keep them up to date on the farm business, cash flow and general progress. This ensures that the bank manager has no end of year surprise.

Conclusion

Single focus on Net Worth.

KISS principle (Keep it Stupidly Simple).

Challenge the concept of retaining equity tied up in the family farm.

Farmers should become better profit takers.

Farmers should do their own budget.

Farm business direction must head toward your life goals.

ii) Breeding and Fertility Management

Sean O'Meara, Richard Meehan, Matt Phelan and Donal Harte

Introduction

Aspects of breeding and fertility management are discussed under the following headings, *fertility management*, *breeds and crossbreeding*, *minerals* and *'cost of service'*.

Fertility management

While there were some variations and the odd exception the following procedure was practised.

Tail painting began one month before AB (AI) commenced. Heat detection commenced from this same date. (On detection the paint colour is changed). Cows not observed cycling in weeks 1 to 3 receive CIDR's. (While CIDR's are widely used at present, farmers visited were looking at alternative ways of getting cows to cycle). This was one week before breeding began which means that most of these cows cycled early in the AB season. While not widely used, Kaymar ($1.80 each) were applied when A.B. began. Cows are observed up to four times per day with paint being topped up daily where Kaymars were not used. AB was used for four to five weeks, followed by stock bulls for four to five weeks – 3 bulls to 100 cows.

Bulls were removed nine weeks into breeding season. Note – bulls were sometimes leased for $350 each. Submission rates in the herds visited was over 90% with a non-return rate of 60 to 65 for first service. (Note LIC's figures for calves born to first service throughout NZ were 50%).

Once a day milking. Cows not cycling in the first three weeks of observation were put on to once a day milking with most cows cycling normally within three weeks.

Flushing. Cows put on a higher plan of nutrition prior to start of AB by tight grazing during the first rotation and lax grazing during the second.

Culling of cows that do not cycle early in the breeding season i.e. not submitted for AB.

Another fertility management tool used in NZ is – *Induction*. This is where late calvers are induced to calve at the start of the calving season (6fi months pregnant) and so have a better chance of going in-calf early the following season, but this is being phased out.

Heifers that are normally grazed on runoff (out farms) were bulled by Jersey stock bulls and all calves were sold off.

Two variations on the above deserve mention.

i) Tail painting and observation began only ten days pre AB. Then ten days into AB non cycling cows can be CIDR'd or put on once a day milking so that over 95% of cows are AB'd in first three weeks. This system is very good where labour availability is an issue.

ii) Cows were tail painted the day before AB started and only observed leaving the milking parlour – intensive observations. Bulling cows were taken out and kept separate until the next milking (to minimise ground damage). The advantage is that it cuts down on observation time, but an extra person is needed at milking for four to six weeks to observe and draft these cows.

Conclusion

Fertility management would rank as the second most important task on any NZ dairy farm, not far behind grass management. In many ways the two are tied together as they manage the grass to assure that there is an ample supply just prior to breeding the cows. Extra labour is employed at breeding time to ensure that the task is completed efficiently. However taking all other factors into consideration, (including their bull and cross breeding programs) the single biggest reason why NZ dairy herds calve more compactly than comparable dairy herds in Ireland, is the use of induction to calve late calvers early. It reduces their calving season by about 30% and if used here to the same extent could reduce our calving season by up to 50%. It will be interesting to see how they will manage when induction is banned and if as some farmers are starting to do, culling the late calves will lead to more fertile cows in the future.

Breeds and crossbreeding

The most notable aspect of the NZ breeding policy is the breeding out of the Holstein-Friesian blood in the Friesian herd, and the use of the Jersey breed in crossbreeding with the Friesian cow.

When deciding what bulls to use on their herd, NZ dairy farmers are happy to use the bull of the day (fresh semen). These bulls will have a high BW (breeding worth), which is heavily weighed towards the production of milk solids. All bulls selected for AB testing are from cows that have calved in the first four weeks of the breeding season. In order to keep BW and Genetic Merit high, only heifers by AB sires whether Friesian or Jersey are being bred back into dairy herds.

Genetic evaluations conducted by Bill Montgomery (LIC), where Jersey bulls are crossed with Friesian cows are showing a marked improvement in hybrid vigour (heterosis). The Friesian X Jersey crossbred animals are easier to calve, have better feet, are much lighter and so easier on the land in bad weather. It is believed that Jersey and Jersey cross cows are the most efficient converters of feed into milk solids, which suits the payment structure of the NZ dairy system. Problems that farmers are faced with cross breeding are what to cross back on the crossbreed in order to continue the rate of improvement. At the moment there is mixed opinion on this with some farmers opting for the Jersey again, and others selecting on the appearance of the first cross cow. The downside for Irish farmers in crossbreeding Jerseys with Friesian is the loss in calf value, which is not an issue in NZ as calf prices are low and the loss of income from selling replacement stock which is a significant part of many Irish farmers income.

Conclusion

Having studied the results of the crossbred NZ herds, it was concluded that there is little difference between the infertility of the Irish/British Friesian or NZ type herds, and their NZ counterparts (based on LIC/Dexcel figures). Empty rates for NZ herds range from 4 to 18%, which is definitely achievable in Ireland.

Comment

New Zealand dairy farmers receive their milk solids results within 24 hours of milk collection, which is a huge management tool in relation to herd nutrition during the vital breeding season. Over 90% of dairy farmers in NZ milk record which leads to a very reliable 1st proof for all the bulls of the day, and helps to fast track genetic improvement. Since almost all farmers raise replacements by AB bulls only, the AB technicians are able to check the breed of every cow with the aid of a computer handset so as to avoid close breeding. All AB is done by technicians. This is one job less to do for farmers, something we cannot financially justify doing in Ireland because of our poor breeding policy.

Minerals

In NZ, minerals are administered in various ways, e.g. *through the water*, *dusting paddocks*, or *oral drench*. Cows are blood tested (1 in 80) for deficiencies prior to breeding, and where possible if a deficiency is detected, minerals are administered through the water. In severe cases, animals are drenched daily during the breeding season with copper, magnesium and also drenched for bloat. Where there is no major problem, paddocks are dusted for staggers (grass tetany).

Conclusion

It would appear that heavy doses of individual minerals are being administered without due regard for the effect on the overall balance of minerals in the cows system.

Cost of Service

As previously referred to, due to the structure in place for proving young bulls and the whole bull of the day scheme, the cost of AB to NZ farmers is quite low at $15 - $17 per head (€8 - €10). New Zealand dairy farmers use a percentage of test bulls on their herds at a cost of $4 - $5 (€2 - €3) per service.

Conclusion

There is major potential for Irish dairy farmers to increase profitability through improved breeding and fertility management. However, the Irish breeding industry has to make major improvement in its structures for this to be achieved. Farmers can change from using Holstein-Friesian, low protein bulls to imported bulls that suit their systems. If we had our own proven BW bull pool and using trained technicians we could further reduce our AI and labour costs.

Over 90% of NZ dairy farmers milk record, so bulls can be proven very quickly, but they have to record only twice a year to satisfy the requirement for proving test bulls. The low cost of only recording twice a year would attract far more Irish farmers to use test bulls on their herds and this would be a first step on the road to improving our whole breeding industry.

It would be a major step forward to have our own selection of high EBI (BW) bulls to choose from (as they have in NZ) instead of having to use imported semen at a high cost to help improve Irish breeding and fertility management.

iii) Industry and Structures

Tim O' Leary, Nicholas Kelly and John O'Sullivan

Introduction

The industry and its structures are examined under three headings, *equity partnerships*, *share milking* and *the dairy industry*

Equity partnerships

Equity partnerships are used by NZ farmers to expand their business in dairying since land prices have risen so much in recent years. There is also an attitude that the 50:50 share milking system is currently too generous to the sharemilker. With low milk prices, the value of land and milk shares is not adequately paid for. An equity partnership is where a number of people pool resources to invest in a business venture, e.g. a dairy farm. The critical components involved in such a partnership are based on a written agreement with each party having equal voting rights irrespective of shareholding. This agreement is normally of a 3 to 5 year duration with a sunset clause, i.e. at the end of the agreement the partners can decide to continue, re-structure, or cash in. The shares in the partnership are tradable with the consent of all partners either to a third party or more likely the other partners will buy out a retiring member. The most suitable arrangement is where one partner is working the farm, as a manager as this leads to hands on involvement. In order to secure the right person to work the farm equity could be secured on his behalf by one of the other partners. Strict budgets are done annually for the business and there is regular reporting to all partners. Partnerships are run as a company and pay tax @ 33%. There is no capital gains tax in NZ and this makes capital growth a very attractive way of increasing wealth, which is probably what, really drives equity partnerships.

Share milking

Share milking is part of an established system in NZ for people with ability to enter dairy farming. People get their first foot on the ladder by contract milking cows. This is where they develop their managerial skills and build up some capital. The next step is for the person to buy cows and enter a share milking agreement. The most common share milking agreement is a 50:50 one where the farmer owns the land and buildings and the share milker owns and milks the cows. The proceeds are divided equally. The final step is where the share milker buys his own farm, has the cows to stock it and is in business.

The industry

The three critical components of the dairy industry in NZ are: Fontera (milk processing and marketing), Dexcel (farm advice and agri research) and LIC. (Livestock Improvement Corporation for animal breeding and performance testing). These three industry branches are all farmer owned co-ops, funded, controlled and run by farmers.

Fonterra was formed in October 2001 by the amalgamation of the NZ dairy board, Kiwi co-op and the NZ dairy group. A board of nine elected farmer shareholders controls Fonterra, elected directly from 13,000 co-op shareholders plus 4 non-farming directors. There is also a shareholders council with forty-six members elected by shareholders in 25 different wards throughout NZ. This council is completely separate from the board of Fonterra with its own office management and staff. Its principal duty is to set the true share value of Fonterra each year. It deals with milk complaints, monitors the board performance, and disseminates information from farmers to the board and vice versa. Fonterra is now an established major player on the world dairy market, selling NZ dairy products into 120 countries. Its strategy is quite simply to maximise milk price and markets for NZ dairy farmers.

Dexcel is the main farm advisory service in NZ with both an advisory and research role. It is a farmer owned co-op funded by a levy on milk sales. This gives all farmers in NZ free access to advisory services, normally in the form of discussion groups. It operates under four principles: -

- Plan for success;
- Feed for profit;
- Farming for tomorrow;
- People for dairying.

LIC is the main breeding and herd performance-testing co-op in NZ. It herd tests 81% of all NZ cows and performs 77% of all A.I. Its scale allows it to run an extremely efficient progeny-testing programme, which provides bulls ideally suited to the NZ dairy industry. LIC. also provides a specialist farm consultancy service called Farmwise that farmers pay for separately. LIC is a co-op whose shareholders are its users.

iv) Grassland Management

David French, Ambrose Rowe and Donie O Donovan

Introduction

Grass is the engine that drives NZ dairy farmers profits and low cost. Consequently, the management of their grass to maximise growth and utilisation per hectare is paramount. An essential feature of efficient grassland management is the provision of farm infrastructure (see (v) below). Grassland management is examined under a number of headings: -

- Stocking rate;
- Grass budgeting;
- Winter-feed budgeting.

Stocking rate

This varied enormously, ranging from 2.8 to 4.1 cows per hectare. It is affected by: -

- Local growth rates;
- System of wintering stock, whether on home farm or on an outside farm;
- Level of supplements bought onto farm;
- Level of nitrogen and soil fertility (P+K);
- Quality of land;
- Quality of grass swards;
- Ability of farm manager;
- The balance between per cow or per hectare milk output

Thus, the very high stocking rates could really be described as cows per feed hectare, while the lower ones are cows per forage hectare. The following target drives stocking rate calculation: - ***80 –90 kg of animal liveweight per t DM produced or available.*** For instance if a farmer grows 16 t grass DM/ha and buys in 1.35 t DM supplementary feed (maize, meal, grass silage, hay etc), then there are 17.35 t DM feed available. This means the farm can carry 1561 kg of cows/ha, calculated by multiplying 17.35 by 90. Therefore, this farmer will aim to carry a stocking rate of 3.47 cows/ha, if each cow (average) weighs 450 kg (1561/450).

Grass budgeting

This is a 'must do' management chore on all farms. It takes the form of a 'spring rotation planer' or a computer programme. Measurement is achieved by means of a weekly walk with a plate metre or eyeballing. Some large farmers (200 - 400 ha) will eyeball as they drive a quad or jeep through the fields because of the time factor. Over time each farmer will have established individual grass cover targets for the critical times - *drying off date*; *calving down date*, and '*Magic day*', that is, when grass growth matches animal demand.

Budgeting allows farmers to identify grass surpluses and deficits early. Surpluses are either saved as pit silage, wrapped silage (known as gift-wraps), hay or saved for deferred grazing. Deficits are generally dealt with in two ways, depending on the system of farming, *viz*. –

Low input system per cow: - this option involves drying off thin cows plus heifers, selling cull cows and empties, or 'controlled starvation'. The principal for the latter being to stick with the necessary rotation length for the time of the year, taking a 'hit' (loss) on milk yield and body condition.

High input system per cow: - the basic aim here is to maintain yield and cow condition by purchasing supplements or using home produced pit silage.

Grass budgeting is so much part of the NZ psyche that little is recorded in paper, but grass is measured weekly so that the average cover can be compared with targets, which are known to each farmer from experience.

Winter-feed budgeting

Since winter-feeding is the most expensive part of the NZ system, a lot of thought is put into providing winter feed for the lowest possible cost. The options are: -

'Grazing off' - where 'winterage' is rented from another farmer and cows are managed daily by the grazer or the owner of the cows. This costs €7 – 12/cow/week, and can be very expensive depending on supply and demand.

'*Run off*' - where the herd owner feeds the cows as in '*grazing off*' but has purchased the necessary land, even though it is away from the home farm. Interestingly, the daily allowance is 13 - 14 kg DM/cow/day depending on land price, whilst it costs €12 – 15/cow/week.

'*Herd House*' - where feed is produced on home farm or forage bought in and fed 'feed –lot' type from stand off pads. Cost varies, but tractors, feeders, yards, slurry etc., are pushing costs very high.

'*Forage crops*' - stubble turnips, swedes, kale, rape, and triticale can be fed *in situ* with baled silage or hay on the owner's farm or on rented ground.

Nitrogen is regarded as a supplement and they use it to create surplus grass, calculated at a yield rate of 10 kg grass DM/kg nitrogen used. Nitrogen is used at the rate of 90 to 240 kg/ha. Clover seems to be very scarce on the 'top' farms.

Conclusions

Grass and feed budgeting plus high stocking rates with judicious use of nitrogen drives high utilisation of grass in NZ. Tight grazing of the first rotation and some topping maintains quality grass. Wet weather grazing techniques are essential to minimise ground damage and maximise grass utilisation.

v) Best Practices New Zealand – Farm Infastructure

Brendan Meagher, Billy Kennedy, Michael Kelly and Shane Fitzgerald

Introduction

Infrastructures on NZ dairy farms will be investigate under the following headings: -

- Cow tracks;
- Paddock system;
- Milking parlour;
- Milk collection;
- Calf and heifer rearing.

Cow tracks

Considerable thought is invested into the strategic location of roadways, with a view to optimising access to all parts of the farm. The width of the roadway is largely dependent on herd size, e.g. Alistar Rayne farm; 650 cows - the road was 10 m wide. Features of all the roadways inspected were no sharp bends, a good camper and generally a satisfactory surface. Cow flow to and from the parlour was excellent in most cases. Roadways were also generally higher on wet farms (used as stand-off in wet weather) and on farms featuring borderdyke irrigation. Most of the farmers visited placed huge emphasis on the slow movement of cows on roadways (good stockmanship) to minimise the amount of lameness in the herd.

Paddock system

The paddock systems on all farms visited were very impressive. All paddocks were numbered and in most cases of equal size as an aid to management. Generally there were two entrances to each paddock from the roadway, and also access between adjoining paddocks. Fencing in general was excellent and shelterbelts were a strong feature particularly on the South Island. Paddocks were serviced by centrally located water troughs (360 gals) serviced by 40 – 60 mm mains (looped system). High output ballcocks featured on all troughs.

Milking parlour

The majority of parlours visited were herringbone. Rotary parlours featured strongly on new conversions on the South Island. The herringbone parlours were of a basic design, curved romp rails, adjustable breast rail etc. The drafting systems on both types of parlour were simple but very effective. Cow flow into and exiting parlours in all cases was excellent (no sharp bends, dark areas etc). In the future it is likely that the rotary parlour will become increasingly popular due to its higher output and better working conditions, but they are twice as expensive.

Collection yards were of either a circular or rectangular design, featuring motorised backing gates and in some cases automated yard-washing systems.

Milk collection

Efficient milk collection and co-ordination was impressive. High capacity tankers, well signposted farms (Fonterra Creamery No XXX) and good access to storage tanks on farms (roundabout) resulted in extremely efficient milk collection. The introduction of GPS to help optimise milk collection runs is an interesting new development. Milk testing is carried out each day by an independent milk testing company (covering all of NZ). Test results are made available to each farmer the following day, informing him of yesterdays fat and protein percentages, presence of bacteria, supply comparison with last year etc.

Calf and heifer rearing

Calf rearing systems in NZ are designed to be simple and labour efficient. Calves are collected from the calving mob each morning (and evening if weather is poor), navels are sprayed and calves removed to the calf house. Two litres of saved colostrum is fed in two feeds per day for the first 10 - 14 days. Calves are grouped according to age, bedded on woodchips or sawdust (labour saving – no maintenance) in open fronted sheds. Calves have access to pellets, water and hay/straw.

At two weeks of age calves are generally turned out to a sheltered paddock (additional shelter is often provided i.e. homemade huts) and fed 3 - 4 l milk a day. Calves are weaned when target weights have been reached i.e. 70 kg for Jersey's, 90 kg for Friesians. At this stage calves are generally moved off farm for rearing until calving. They graze on a weight gain contract or a per head weekly fee – the former being best. Maiden heifers are generally mated to Jersey bulls before the main herd to facilitate early and trouble free calving. Target weights at calving depend on breed i.e. Jersey 400 kg, crossbred 450 kg and NZ Friesian 500 kg.

Conclusions

Infrastructures and systems on NZ dairy farms are designed to be simple and uncomplicated in order to maximise labour efficiency and profitability. Each labour unit has a clearly defined role with involvement in management to varying degrees. Each labour unit on the most efficient farms can manage approximately 200 cows, working a 60-hour week during the calving & breeding season and a 40-hour week for the remainder of the year.

The emphasis is on working efficiently per hour rather than on the number of hours worked. The cornerstone of the NZ dairy industry is simplicity, efficiency and profitability.