Moorepark Dairy Production Research Centre,
Teagasc,
Fermoy,
Co. Cork

Tel : 025 – 42222
www.teagasc.ie

Moorepark Dairy Levy Research Update

Moorepark Dairy Production Research Centre

Tuesday & Wednesday, 6th & 7th January, 2009
Series 9

Components of Dairy Herd Expansion: Heifer Rearing and Herd Health

National Development Plan 2007 - 2013

Agriculture and Food Development Authority

Moorepark Dairy Levy Research Update

Tuesday & Wednesday, 6th & 7th January, 2009
Moorepark Dairy Production Centre

Series No. 9

Components of Dairy Herd Expansion: Heifer Rearing and Herd Health

Moorepark, Dairy Production Research Centre
Teagasc
Moorepark
Fermoy
Co. Cork
www.teagasc.ie

Table of Contents

Foreword 5
Pat Dillon, Head of Centre

Developing new systems of heifer rearing 7
Emer Kennedy, Frank Buckley and David Gleeson

Off-farm rearing of replacement heifers: New Zealand experience 14
John Donworth, George Ramsbottom and Ríona Sayers

Out-wintering on forage crops – options for maiden heifers 23
Padraig French and Bill Keogh

Teagasc/Dairygold Milk Quality Programme 29
Don Crowley and Tom Weldon

Practical steps to improve milk hygiene 35
David Gleeson and Bernadette O'Brien

"€uroMilk"- A team-based approach to on-farm mastitis and milk quality issues 41
Finola McCoy

How to recognise and control BVD and IBR 44
Ríona Sayers

Foreword

Pat Dillon, Head of Centre
Teagasc, Moorepark Dairy Production Research Centre, Fermoy, Co. Cork

Milk production in Ireland has been curtailed by milk quotas since the early 1980's. It is now accepted that the EU Commission's intention is not to extend the dairy quota regime beyond 31 March, 2015. The outcome of the EU Commission's 'Health Check' of the MTR process is now known, allowing for a 1% increase in milk quota each year for the next five years (2009/10 to 2013/14) which is additional to the once off 2% increase agreed in 2008/09. Additional to this it was agreed as part of the 'Health Check' to reduce the butterfat adjustment coefficient from 0.18 to 0.09 where fat content exceeds the reference level which will potentially increase Irish milk quota by a further 2%. Also as part of the 'Health Check' it was agreed to further review the milk quota position in 2010 and 2012 ensuring the gradual reduction in the value of EU milk quotas. This will enable producers to increase production without incurring additional quota costs, provide a soft landing for those exiting production, and minimise market instability arising from the ending of the milk quota regime. With reduced market support for dairy products milk price volatility will be a key component of the industry in the future. The implications of this are an inevitable drive to increase production efficiency, increase scale and reduce costs. Adoption of innovation borne out of the ongoing research at Moorepark is critical to future success.

Effective herd expansion requires the adequate provision of high genetic merit replacement heifers. This scenario calls for a rethink with regard to rearing and management practices; low cost low labour strategies that will not compromise subsequent production potential are required. Research is ongoing at Moorepark aimed at developing blueprints for low cost heifer rearing that will complement futuristic dairy production systems. Potential components being evaluated include once-a-day calf milk feeding from five days of age, outdoor calf rearing, off-farm heifer grazing systems, the role of white-clover, outdoor versus indoor wintering etc.; essentially enabling dairy farmers to increase scale while at the same time minimising the unit cost of production. In New Zealand the practice of off-farm grazing or contract rearing is almost a routine practice of intensive dairy enterprises. An insight into these key issues surrounding heifer rearing are presented in this series.

The importance of herd health status is amplified within the scenario of expanding herd size, primarily due to the potential hazard of mixing animals of varying herd health status. Sub-optimal udder health and the prevalence of infectious disease continue to present enormous challenges at farm level. Disease control, biosecurity, and on-farm health planning will prove crucial to achieving optimal efficiency. During 2008, Moorepark initiated a number of new herd health research initiatives aimed at addressing many of these herd health issues and providing clear guidance to Irish dairy farmers going forward.

This Open Day at Moorepark allows an opportunity for dairy farmers and the service industry to farming to discuss some of the recent developments in replacement heifer rearing, heard health and production of high quality milk with Teagasc Research and Advisory staff. The financial support for the research programme from state grants and dairy levy research funds is gratefully acknowledged.

Developing new systems of heifer rearing

Emer Kennedy, Frank Buckley and David Gleeson
Teagasc, Moorepark Dairy Production Research Centre, Fermoy, Co. Cork

Summary

- Achieving target bodyweight gains is an integral part of heifer rearing systems.
- Bodyweight and condition score are more critical to achieving high submission rates early in the breeding season than age.
- Less labour required with once-a-day milk feeding.
- Calf weight is not adversely affected by once-a-day milk feeding.
- Investigation into the viability of kale as a winter feeding option for weanling is being evaluated.
- Development of a complete replacement heifer rearing blueprint under way.

Well-bred well-grown heifers the key

Heifers determine the future genetics, production potential and efficiency of the dairy herd. The objective of heifer rearing should be to maximise profitability by optimising growth to reach specific targets aimed at optimising lifetime performance and rearing costs. Well-bred maiden heifers should represent some of the highest genetic material in the herd and they have the potential to substantially impact on herd profitability. Frequently, the heifer rearing component of the overall dairy system is overlooked despite important long-term effects on subsequent milk production performance. This paper will outline the target weights that should be achieved at key points in time during the rearing process. It will also discuss research, currently being undertaken in Teagasc Moorepark, which will determine best practice to achieve these targets. As with any aspect of dairy farming it is critical that the associated cost relating to rearing a replacement heifer is known so that the efficiency of the system can be improved. The net cost of rearing a replacement heifer is estimated to be €1,533 per head (Shalloo, personal communication – for more detail see paper by Donworth and Ramsbottom later in this booklet). This data shows that rearing replacement heifers is expensive and places a heavy demand on dairy farm resources.

Given the large cost associated with rearing the replacement dairy heifer it is critical that heifers are reared using best practice methods so that they achieve the specified target weights at key points during the rearing process thus ensuring that associated costs are kept to a minimum.

Importance of achieving target bodyweight and body condition score

Achieving target bodyweight gain is an integral part of heifer rearing systems. Heifer rearing programmes should target a specified age at first calving and target liveweight or proportion of mature liveweight on this date. Previous research has indicated that heifers should be mated at 55% to 60% of mature liveweight and should calve at 85% to 90% of mature liveweight. However, recommended mature liveweights vary considerably between countries. For example, in the US mature liveweight for Holstein cows is deemed to be 650kg. In New Zealand, however, this is at least 100 kg less. In practice on many Irish dairy farms heifer rearing receives low priority and achieving target weights is not an issue of concern. As a result potential milk production is unlikely to be realised. Reduced levels of management will result in a lesser profit, as heifers may calve later than 24 months and produce less milk compared to better managed heifers. Well-bred heifers, if calved early, have a capacity to significantly improve herd calving pattern and when mated to high EBI sires will provide a source of early-born high genetic merit replacement heifers for the future development.

As part of the large on-farm Norwegian Red crossbreeding study run by Moorepark, almost 1,400 dairy heifers were intensively monitored for three years from three months of age on over 40 dairy farms. This data set was used to establish best guidelines in heifer rearing management.

At MSD (mating start date) the average weight and body condition score (BCS) was 326 kg and 3.28 BCS for heifers that were cycling and was 290 kg and 3.10 BCS for the non-cycling heifers. Averaged across all herds the level of cyclicity was 79% ranging from 31% in the poorest herd to 100% in the best herd. The data also showed that it was possible to have heifers at the desired bodyweight and BCS at less than 13-months of age at MSD and to calve at 22-months of age (Table 1). The following key points were evident from the study:

- **Bodyweight and condition score** of the maiden heifers at MSD was more critical than age with regard to achieving high cyclicity rates.
- Heavier heifers produced significantly more milk in their first lactation .
- Heifers in low BCS at MSD calved later and produced significantly less milk during first lactation.
- Weight at first calving also significantly affected second lactation milk yield.

Table 1. Association between maiden heifer age, liveweight and body condition score at the mating start date (MSD) and cow production performance in first lactation

	Mean calving date	Predicted 305 day yield	Predicted 305 day fat %	Predicted 305 day protein %	Milk produced
Age at AI (months)					
<14	Feb 23	5322	3.96	3.47	4648
14 to 14.5	Feb 22	5294	3.99	3.47	4587
>14.5	Feb 23	5223	4.04	3.47	4439
Weight at AI					
≤290kg	Feb 25	5003	4.02	3.46	4186
291 to 316kg	Feb 23	5235	3.99	3.46	4428
317 to 341kg	Feb 21	5340	4.03	3.48	4722
≥342kg	Feb 21	5540	3.96	3.49	4897
BCS at AI					
≤2.75	Mar 4	4963	4.09	3.49	4053
3.00	Feb 21	5283	3.94	3.45	4615
3.25	Feb 20	5387	4.01	3.48	4791
≥3.50	Feb 21	5485	3.95	3.46	4773

Recommendations

- The target bodyweights outlined in Table 2 must be achieved. In addition, maiden heifers should have a minimum BCS of 3.25 to ensure at least 90% are cycling at MSD.
- These target weights at MSD are equivalent to 60% of target pre-calving first lactation weights.

Table 2. Bodyweight targets for maiden heifers at breeding and for heifers pre-calving by breed/crossbreed

	HF	NZ	HF*NZ	NR	HF*NR	J	HF*J
Maiden heifer LW(kg)	330	315	330	315	330	240	295
Pre-calving LW (kg)	550	525	550	525	550	405	490

HF = Holstein-Friesian, NZ = New Zealand HF, NR = Norwegian Red, J = Jersey

- Young heifers, even those less than 13-months of age at MSD, can be reared to reach these weight/BCS targets before MSD.
- Aim to have heifers at grass at least one month prior to MSD.
- Sires with direct calving difficulty PTA values of 2.0 or less (consult figures provided by ICBF) are recommended as suitable for use on maiden dairy heifers.
- A prostaglandin synchronisation programme works well with breeding replacement heifers - but heifers must be cycling first.

Calf rearing research at Moorepark

Rearing the pre-weaned calf can be extremely labour intensive. Approximately 7% of one labour unit per day on a dairy farm is associated with calf care over a 12-month period. Labour requirements for calf care peak during the calving period with a high demand for labour continuing for up to 12 weeks. An ideal scenario would be to minimise the labour input required during this time yet not compromise calf health and welfare. A study investigating the labour input associated with calf care on Irish dairy farms was recently carried out by Teagasc Moorepark. This study found that the labour associated with calf care was influenced by herd size and calf feeding system. Practices such as grouping calves and feeding once-a-day will reduce labour. From Table 3 it is evident that once-a-day feeding requires the least labour input (23 sec/calf/day), in addition calf weight at 77 days is not adversely affected.

Table 3. Effect of calf feeding system on daily labour input, calf weight and weight gain

	Automatic feeder	Once daily with teats	Twice daily with teats	Twice daily with trough
Total calf care time incl. vet. time (sec/calf/day)	38	23	36	27
Calf weight at 77 days (kg)	95.0	94.8	93.2	90.5
Calf weight gain per day (kg)	0.70	0.79	0.80	0.65

Heifer rearing blueprint

The Irish dairy industry is currently poised for expansion in the post-quota era. This expansion will result in dairy farmers increasing the stocking rate on the grazing platform. Thus, the likely scenario is that replacement dairy heifers will be reared on an outside parcel of land that is not within walking distance of the milking parlour. Additionally, farmers currently involved in beef production may wish to capitalise on the expansion of the dairy industry and convert their enterprises into contract heifer rearing (see paper by Donworth and Ramsbottom page 14 in this booklet) facilities for dairy farmers. This imminent change in the rearing of replacement dairy heifers necessitates the development of a blueprint that will guide all farmers and will result in high quality heifers entering the dairy herd. A new project which will develop optimal management practices for replacement heifers entering the Irish dairy herd has just commenced in Moorepark. The objective of the research is to develop best practices of rearing replacement heifers from the newborn to pre-calving stage. It will incorporate best strategies of calf rearing and will define optimum over-winter practices, all of which will be integrated into the development of a complete replacement heifer rearing system.

Outdoor versus indoor calf rearing

The first task commenced in spring 2008. The aim was to establish the viability of outdoor rearing systems compared to more traditional indoor rearing systems. It will determine if calves can conceivably be moved to an outside parcel of land during the first week of life and have weight gains and vitality similar to calves reared indoors. The experiment began on 30 January 2008. Calves were assigned to their treatment (indoors or outdoors) at one week old; calves weighed on average 34 kg at birth. All calves were offered milk twice daily for the first four weeks and once daily for the next five weeks – and were weaned at nine weeks old. Shelter was provided for calves on the outdoor treatment as shown in Picture 1. Results from the study indicate there was no difference in weaning weight or calf development between the calves reared indoors and outdoors (Table 4).

Table 4. Preliminary results of heifer calves reared indoors and outdoors for nine weeks pre-weaning

	Indoor rearing	Outdoor rearing
Weaning weight (kg)	69	71
Weaning shoulder height (cm)	83	84
Weaning heart girth (cm)	97	99

Picture 1: Outdoor reared heifer calves with shelter visible in the background

Outdoor versus indoor wintering options

A further objective of this project is to develop low cost over winter options for weanling heifers. Kale, a brassica crop, is approximately 1.05 UFL/kg DM and costs 11.8 c/kg DM while grass silage, the more traditional winter feed, is approximately 0.80 UFL/kg DM and costs between 16.1 and 17.1 c/kg DM. The hypothesis is that heifers can be wintered outdoors on a cheaper higher energy feed than grass silage and have weight gains similar, if not greater than, those of indoor reared heifers. Feeding a fibre source, such as silage bales, is a requirement when offering animals crops such as kale. However, this gives rise to labour and feed costs, so part of the current study is to evaluate if offering a 100% kale diet (treatment i) is feasible in terms of heifer weight gain and most importantly health. The current study has four treatments in total. The other three treatments are as follows:

ii) 70% kale + 30% grass silage
iii) Good quality silage (>70% DMD(dry matter digestibility))
iv) Poor quality silage (<70% DMD)

The optimum treatment will be determined by monitoring animal performance during the wintering period but also subsequent fertility and productivity of these heifers will be monitored. Furthermore, a cost analysis will be completed for each treatment which will incorporate feed costs as well as animal performance.

Early versus late turnout to pasture

A study to quantify the effect of turning heifers out to pasture in early spring will also form part of the blueprint development. Indications from the heifers monitored as part of the large on-farm crossbreeding study suggested that heifers grazing for an extended period of time before the start of mating achieve greater condition scores and greater cyclicity rates compared to heifers indoors or those turned out to pasture 2-3 weeks pre-breeding. Therefore, half of the animals from each of the four treatments outlined above will be turned out to pasture in early February and the remaining half of each treatment will be turned out approximately three weeks prior to MSD.

A role for clover

Due to the recent increase in the price of N (nitrogen) fertiliser and the cost of applying N (labour and tractor costs) it is considered prudent to evaluate the potential of high clover systems as a lower cost alternative. The final component of the project is to develop a sustainable system that will incorporate the optimal management strategies determined from the experiments outlined above. A number of systems will be investigated – it is probable that they will integrate grass/clover swards with low cost out-wintering options and compare them to pure perennial ryegrass swards and more conventional indoor accommodation offering grass silage during the winter period.

The aim of this series of experiments is to combine the best aspects from each of the above mentioned tasks and devise a blueprint or a model for replacement heifer rearing that farmers can replicate on their own farms, particularly relevant in an expanding scenario. In doing so the target bodyweight and condition scores, outlined above, will be achieved and subsequent heifer production will be maximised when they enter the dairy herd.

Picture 2: Weanling heifers eating kale

Off-farm rearing of replacement heifers: New Zealand experience

John Donworth[1], George Ramsbottom[2] and Ríona Sayers[3]

[1]Teagasc, Advisory Services, Moorepark, Fermoy, Co. Cork; [2]Teagasc, Advisory Office, Oakpark, Carlow; [3]Teagasc, Moorepark Dairy Production Research Centre, Fermoy, Co. Cork

Summary

- The rearer is the single most important piece of the off-farm rearing jigsaw.
- New Zealand experience suggests that ex-dairy farmers tend to be the best rearers.
- Contracts offer limited protection – more a guide to key management practices to be adhered to rather than legal document.
- Animal disease is an ongoing risk but to minimise the issue:
  - Establish the herd disease history on the rearer's farm
  - Send heifers to "TB-free" areas only.

New Zealand off-farm heifer rearing

In New Zealand, over 95% of the one million yearling replacement heifers are reared off the main grazing platform. In addition, three-quarters of a million weanling heifer calves leave the owners farms on 1 December (the approximate equivalent of 1 June) to graze off-farm as well. The main reason why heifers are grazed off is because of the high stocking rates on the grazing platforms in New Zealand – the national average is 2.8 cows/ha.

The profitability of drystock farms is reportedly similar to that in Ireland without the Single Farm Payment. Demand for quality heifer rearers is high and exceeding supply. In the past 10 years, the dairy herd in New Zealand has increased by approximately one-third to 3.9 million cows with a proportional increase in the number of replacement heifers. In addition, the area of land devoted to maize growing has increased. Typically, heifers are being grazed on drystock farms which are less suitable for dairying (due to altitude, gradient or soil quality issues).

Contract rearing

Formal written contracts for rearing replacement heifers have been in place for over 20 years in New Zealand. Approximately 70% of heifers are grazed off-farm with a written contract in place. The balance don't have a written contract and usually involve owners and rearers who have a long established business relationship.

One of the leading companies that specialise in off-farm rearing of replacement heifers has altered its template contracts 16 times over the past 20 years to reflect changing requirements. The most recent grazing company contracts emphasise the trend from a pay per week basis to payment based on 'guaranteed' liveweight gain. Written agreements tend to include details relating to:

- Dates of arrival/planned removal of animals to/from the rearers farm
- Final and intermediate weights
- How mortality will be addressed
- Dosing and vaccination programmes – who pays/who administers
- Breeding programme – bull sourcing/type
- Transport of animals.

Farmer experience with replacement heifer contracts is that they are not foolproof. When difficulties arise, the contracts will not protect the owner. In general, the return home or disposal of empty heifers is treated as a cost to be borne by the owner with no implications for the rearer. However, the treatment of the death of a replacement heifer varies with the arrangements agreed between the heifer owner and the heifer rearer. In some agreements, heifers are paid for up until the date of death. In other cases the rearer returns any income earned for the heifer from the date that she arrived on the farm.

Disease control in New Zealand

TB is not a widespread disease in New Zealand (0.34% of herds are affected nationally). Areas are designated high risk (movement control areas) or low risk areas. In low risk areas animals over two years of age are TB tested once every three years. In high risk areas animals over two years of age are tested annually.

The control of Bovine Viral Diarrhoea (BVD), however, is a major issue. Vaccination of heifers usually takes place on the rearers' farms. This is done primarily for insurance purposes to ensure that high pregnancy rates are obtained as heifers from different sources are mixed on rearers farms. In addition, stock bulls, by far the most commonly used method of breeding heifers, are usually BVD tested before they are introduced to the breeding mobs on the rearers' farms. This test is carried out to identify the persistently infected (PI) stock bulls and ensure that they do not come in contact with the heifers.

Contract charges

Where no formal contracts exist, such private rearers tend to be paid on a per head per week basis. These payment systems tend not to have liveweight targets incorporated. They operate most successfully where established grazers with proven track records consistently deliver replacements of the required standard. Generally such rearers are in high demand and deal with the same group of customers over a long period of time so opportunities to avail of their services are limited. The cost quoted varied:

- €3.00 - €4.00 per head per week for weanling heifers (~4 to 9 months of age)
- €3.50 - €4.50 per head per week for yearling heifers (9 months+)

Fixed price contracts with a 'guarantee' to achieve a certain liveweight gain are the second payment system. Such contracts are more commonly employed by contract rearing companies. Heifer liveweight gain is monitored frequently (every 6-8 weeks) as such weighings form the basis for payment and are a useful means of informing the owner of how his animals are performing. These contracts usually have inbuilt bonuses and penalty clauses for liveweight gain above or below the agreed targets. While generally higher cost, the additional costs involved are viewed as an insurance policy to ensure that the appropriate liveweight gains are being achieved. The cost quoted for such systems varied also:

- €3.00 - €4.50 per head per week for weanling heifers
- €4.00 - €5.50 per head per week for yearling heifers

In general, payment is made on a first of the month basis directly into the grazier's bank account. In addition to the 'bed and breakfast' costs outlined above, extra costs are also being incurred while heifers are off-farm. These include the costs of bull hire, dosing, vaccination and synchronisation programmes and transport. Underpinning the prices charged for rearing replacement heifers off-farm is an assumed value per kg of grass dry matter consumed by the replacement heifer. For example, a yearling heifer is estimated to consume approximately 2.6 tonnes dry matter during the 12-month period prior to her return to the owner's farm. At a cost of €5 per week off-farm, total grazing costs are €260 per head – 10 cent per kg DM. This is compared with the cost of alternative feeds such as maize silage or palm kernel which are costing 15-20 cent per kg DM. Obviously it is also assumed that stocking rate on the 'grazing platform' is sufficiently high to ensure that all of the dry matter grown there is consumed.

Potential application in Ireland

Contract heifer rearing is an option worth considering in the following situations:

- Where overall farm profit can be increased by replacing heifers with cows
- Where labour is a limiting constraint
- Where land is a limiting constraint
- Where replacement heifers are failing to reach the target liveweights
- Where separation of cows from replacement heifers (even calves) is required for disease control purposes e.g., Johne's Disease.

As a general rule, land on the grazing platform is not a limiting constraint below a stocking rate of approximately 2.7 cows per hectare (on high quality free draining soils). Profit per hectare will be the key driver of farm profitability in the future. The profits obtained per hectare on the top 10% of spring milk dairy farms completing Profit Monitor in the 2005-2007 period averaged €2,263 per hectare over the three years. However profit alone may not be the reason why a dairy farmer would consider grazing replacements off farm.

From the rearer's perspective there can be a similar list of benefits. Many former livestock farmers have buildings and labour available but may be reluctant to invest significant capital in a new or existing enterprise. In addition, if they are former dairy farmers they will miss the monthly cash injection that used to be provided by the milk cheque. Heifer rearing provides a way to utilise buildings without the requirement for a high level of investment and in many cases it can be operated as a part-time enterprise. Other issues that should be considered from the rearer's perspective include:

- The need to go to the livestock mart to buy and sell stock is reduced
- The cash flow and business risks associated with a drystock enterprise are reduced
- The business may return a higher profit than the rearer's existing enterprises.

Disease control

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

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

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

- Establish the current disease status of the herd of origin. Such information is important in determining the likelihood of disease exposure before the heifers leave the farm, and is absolutely critical to management of the heifer herd once they are re-introduced to the herd. They will need protection (e.g., management and vaccination strategies) against circulating diseases in the herd of origin before their re-introduction.
- Contract to a farm where a single heifer herd is to be reared and preferably where no other animal species are being farmed.
- Should the rearers farm have been actively engaged in farming within the past five years, request a health history on the animals that were farmed there previously. Organisms such as Salmonella and Leptospira can exist for lengthy periods in the environment and cause disease well after farming has ceased.
- Implement a strategic vaccination protocol for heifers based on the disease status of the farm of origin e.g., if required, BVD vaccination should be carried out at a specific time before breeding (specified by the vaccine manufacturer) and heifers should receive a primary course of two injections separated by a correct time interval. Incorrectly administered vaccines will not yield the desired level of disease protection.
- Implement a parasite control strategy to include roundworm, fluke and lungworm.
- On their return to the herd of origin, heifers should be quarantined correctly i.e., isolated for at least 30 days in an area that is at least three metres from other cattle groups, with no sharing of feed or water troughs and no mixing of dung and urine. In this regard, heifers should be returned to the herd of origin at least 30 days before they are due to calve down. Transportation of in-calf heifers closer to their due date should be avoided in any case on welfare grounds.
- During this quarantine period, in-calf heifers should be tested for BVD, IBR, Leptospirosis, Neosporosis and Salmonellosis.
- Should any of the returning animals test positive for any of these diseases, a management strategy for these animals should be discussed with a vet before mixing with the remainder of the herd.
- Calves born to in-calf heifers should be tested for BVD virus as soon as possible after birth in order to cull those persistently infected.
- Outline in writing the biosecurity measures to be carried out by the rearer on his farm. At a minimum these should include;
    a. Maintaining a closed herd policy on the rearer's farm. No cattle should be moved onto the farm during the contract period. A decision can be made as to whether this measure can be relaxed in order to allow animals from the same herd of origin to be introduced. This does pose risks of disease introduction and should only be considered where the disease status of the herd of origin is being monitored on a continuous basis.

b. Should new animals from the herd of origin be introduced to the rearer's farm, they should be quarantined correctly i.e., isolated for at least 30 days in an area that is at least three metres from other cattle groups, with no sharing of feed or water troughs and no mixing of dung and urine. Using an isolated paddock is an ideal solution to avoid problems with indoor quarantine. Use this period to observe the newly introduced animals for any signs of disease.
c. Maintaining both stock- and disease-proof boundaries. Farm boundaries must prevent nose-to-nose contact between different groups of cattle.
d. Use of well-maintained (cleaned and re-filled regularly) footbaths at strategic points on the farm.
e. Use of signage to maintain awareness of biosecurity on the contract farm.
f. Provision of farm-specific basic veterinary equipment e.g., nose tongs. Transfer of nose tongs from one farm to another without sufficient disinfection can result in disease introduction.
g. Use of separate disposable needles for each animal when taking samples or administering medications, including vaccines.
h. Use of separate rectal sleeves for each animal when scanning, examining or treating.
i. Avoiding importation of slurry onto the contract farm.
j. Keeping vehicles visiting the farm at a safe distance from animal areas e.g., housing, holding yards, roadways. This is particularly important in the case of knackery carcass collection vehicles, which should not be permitted to enter farms and should collect carcasses from the farm entrance.
k. Isolating sick animals immediately until a diagnosis is reached and suitable treatment initiated.

It is important to recognise that these measures, once implemented, will act as an insurance policy against infectious diseases. They are not a guarantee that a herd will remain disease free, but will significantly reduce the risk of disease introduction. It is also critical to recognise that implementation of these measures on the contract farm without their implementation on the farm of origin is counter-productive. Heifers reared in biosecure surroundings should be considered an investment and should be afforded the same level of disease protection on their return to the home farm.

The following sections summarise the non-regulated infectious diseases currently impacting Irish dairy farms, the causative agent involved, methods of transmission, the clinical signs (symptoms) and control measures. This information can be used to assist in the recognition of a disease outbreak thereby allowing more rapid intervention and control.

The Department of Agriculture's view is that they will treat off-farm heifer rearing as they treat existing Bed & Breakfast arrangements i.e., Form NBAS31B must be completed and the Certificate of CMMS compliance obtained before any farm-to-farm movement of animals can take place. The Form NBAS31B, obtainable from the DVO, is the particular application for a Certificate of CMMS compliance to record the movement of stock to another location where the ownership does not change (used for slaughter premia purposes in the past).

Regulatory diseases

No more than 5% of herds in the country are restricted by TB/Brucellosis in any one year. The objective, nevertheless, must be to minimise the risk. However, according to the Department of Agriculture, Fisheries and Food the following regulations apply:

- Calves under six weeks of age don't require a TB or Brucellosis pre-movement test as long as they are from a TB/ Brucellosis free herd.
- Calves over six weeks of age require a TB test before movement.
- Entire animals (bulls/females) require a 30-day pre-movement brucellosis test when they are over 12 months of age. Post-movement test for brucellosis is not obligatory but is recommended. Animals will qualify for a higher supplementary rate if a disease outbreak occurs.
- Before heifers can return to the owners farm at 22 months, they must have a Brucellosis 30-day pre-movement test. For TB, a test within the previous 12 months will satisfy the regulations. However, from a biosecurity point of view and to protect the owners stock, it is recommended that a pre-movement test for both TB and Brucellosis be carried out during the last 30 days that the heifers are on the "rearer's" farm. If all the heifers are clear following the pre-movement test, then no further action is needed. Heifers can move home.
- Where one TB reactor shows up out of the group tested, the situation on the particular farms is examined by the Department of Agriculture as each case is likely to be subtly different from any other but in essence:
  - the reactor heifer is valued and goes for slaughter.
  - all the remaining stock on the rearer's farm must now be TB tested. This is done to eliminate the possibility that the one reactor isn't the tip of the iceberg.
  - if the remainder of the herd is free of TB, then the group that needs to be moved are blood tested for TB - this is done to eliminate any false negatives.
  - if the heifers test negative on the blood test, they may return to the owner's farm under permit from the DVO. However, both the rearer's herd and the owner's herd are restricted, and remain so for a minimum of 120 days (following 2 clear tests). Moving heifers 'home' would then have implications for the sale of calves from the owner's farm so that has to be considered in arriving at the final solution.

- where the owner's herd is locked up and the rearer's herd is not, the group of heifers can't move without possible consequences. These include the risk of exposing TB-free heifers to a serious disease risk and/or adverse consequences for future compensation eligibility. However each situation is treated on a case-by-case basis by the DVO involved and a DVO may permit the movement of animals out of a restricted holding in certain circumstances.

Recommendations

To avoid problems, the location where the heifers are reared is all important. For instance "black spots" for animal disease should be avoided e.g., farms where disease outbreaks are occurring every 2nd and 3rd year. Questions such as are the Department checking the badger population in the area for the presence of TB might influence whether a farm might or might not be considered suitable.

Also the heifer rearer should sign an authorisation allowing the owner to check with the Department if the previous herd test results of the rearer's herd were clear and the status of contiguous herds.

It is recommended that heifers are returned to the owners farm six weeks before they calve-down. This is to ensure that they are not being transported on the point-of-calving and are properly acclimatised to their environment so that they also have the required level of 'local' antibodies in their system before calving.

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

Guideline costs

The costs included in Table 1 are those incorporated in the EBI model (Shalloo, personal communication). The net cost of rearing a replacement from birth to point-of-calving is thus expected to be €1,533 per head. The figure includes a charge of €203 per head for the farmer's own labour. A land charge based on an opportunity cost of €194/ha is also included. An adjustment for the cost of empty replacement heifers is incorporated in the model. This data shows that rearing replacement heifers is expensive and places a heavy demand on dairy farm resources. Achieving the target liveweights is a key component of successful heifer rearing. See the target liveweight section of this publication for further recommendations.

Table 1. Costs associated with rearing replacement heifers from five weeks of age to calving at 24 months of age (based on Fischler costs and prices)

Category **Variable Costs**	**Cost (€/replacement unit)**
Concentrates	142
Fertiliser, lime & reseeding	201
Land rental	194
Machinery hire	9
Silage making	89
Vet, AI & medicine	128
Total Variable Costs	763
Fixed costs	
Car use, water & electricity	30
Labour	203
Machinery operation & repair	20
Phone	10
Insurance, A/C's, transport, sundry	39
Interest repayments – term loan	64
Total Fixed Costs	366
Depreciation	
Buildings	55
Machinery	22
Total Costs	1,206
Initial value of the calf	350
Sales of heifers failing to conceive	- 23
Net cost of rearing a replacement heifer	1,533

Out-wintering on forage crops – options for maiden heifers

Padraig French and Bill Keogh
Teagasc, Moorepark Dairy Production Research Centre, Fermoy, Co. Cork

Summary

- Previous Moorepark research shows that dry spring-calving dairy cows can be successfully wintered on kale, swedes and fodder beet supplemented with grass silage with no negative effect on subsequent milk production.
- Kale and forage rape are the two brassica crops most suited to wintering young stock as they are easily grazed and are of high energy and protein concentration.
- Supplementing forage brassicas with a fibre source such as silage, hay or straw is always recommended to maintain rumen function, however, research at Moorepark is currently evaluating the feasibility of offering a 100% kale diet.
- Forage brassicas are deficient in specific minerals, particularly iodine, copper and selenium and these should be supplemented through the most appropriate method.

Grazing forages in-situ – what are the options?

One strategy to reduce the cost of rearing replacement heifers is to utilise feeds, which can be grazed in-situ thereby reducing both variable (harvesting cost) and fixed costs (housing and machinery). Perennial ryegrass, the dominant forage on livestock farms has limitations for out of season grazing (December and January). The quantity of DM that can be accumulated for winter grazing is limited, and additionally as the quantity accumulates the quality decreases. There are a variety of other crops available, which grow at lower temperatures than perennial ryegrass and can accumulate higher yields without a decline in feeding value.

Options for out-wintering include fodder beet, swedes, kale, rape, turnips, forage cereals and short rotation grasses. Fodder beet and swedes have a relatively low (8-12%) protein content and for this reason would not be suitable for young growing animals without protein supplementation, also during the second winter most spring born calves will loose their 'milk' teeth and begin to grow their 'adult' teeth and would not be able to graze root crops efficiently during this period.

Kale is a full season biennial crop usually sown from mid-May to mid-July and requires a six month growing period to maximise yield. The earlier it is sown the higher the utilisable yield. A farm survey of crop yields by Moorepark found that each day delay in sowing date reduced yield by 132 kgDM/ha. Rape and stubble turnips are annuals that can be sown later than kale for use during the same period. However, these will have lower yield potential (typically 4-5 t DM/ha when sown in August) than kale.

Over the last three years Moorepark research evaluated the role of these crops as a winter feed system for dry spring-calving dairy cows. Some of the results obtained have relevance to maiden heifers.

Experiment 1

In June 2005, crops of kale and swedes were sown in Moorepark after harvesting first-cut silage and yielded approximately 11 and 15 t DM/ha respectively by early winter. In early December 2005, groups of 22 cows were assigned to one of four winter diets which were allowances of:

(1) 8 kg Kale and 4 kg bale silage
(2) 8 kg Swedes and 4 kg silage
(3) 12 kg autumn grown grass
(4) Ad-lib silage fed indoors.

The cows remained on their respective diets until approximately one week before calving in mid-February. The cows adapted to the kale very quickly and utilisation was over 80% for most of the winter, however the cows took approximately three weeks to begin eating the swedes and during this time lost approximately 0.3 of a condition score. Once the cows adapted to eating the crop performance and condition score gain was considered satisfactory. The impact of the different winter diets on subsequent cow performance is shown in Table 1.The quality of the silage offered to the indoor group was excellent (77 DMD) and they achieved the highest condition at calving. The cows offered kale and swedes achieved moderate condition scores at calving (>3.15) however the cows offered grass only were well below target condition at calving. There was no effect of winter feeding treatment on milk solids production in the subsequent lactation.

Table 1. The effect on performance of wintering dry spring-calving dairy cows on crops grazed in-situ relative to grass silage fed indoors

	Kale	Swedes	Grass	Silage/indoor
BCS at dry off	2.99	3.03	3.03	3
Calving BCS	3.17	3.17	2.77	3.51
BCS 4 wk post calving	2.87	2.88	2.64	3.2
Calf birth weight (kg)	47	50	47	47
Colostrum yield (kg)	7.21	7.29	6.36	5.92
Milk solids production (kg)	440	452	455	452
Calving to conception interval (days)	92	94	88	86
Empty rate (%)	13	17	6	13

Experiment 2

Crops of fodder beet (variety-Feldherr) and kale (variety-Maris Kestrel) were sown on the 25 April and 4 June 2006 and achieved dry matter yields of 26.7 and 10.2 t/ha, respectively. On the 10 December 2006, groups of 10 cows were assigned to one of six winter diets which were either a high or low allowances of kale, fodder beet or grass silage. Animals offered the high allowance were allocated 9 kg of kale or fodder beet DM in-situ plus 5 kg of ryegrass silage DM while ad-libitum silage was offered indoors in order to achieve 0.5 unit increase in BCS from dry off to calving. Animals offered the low allowance were offered 6 kg of kale or fodder beet DM in-situ plus 3.5 kg of silage DM while 9.5 kg of silage DM was offered to one group indoors to maintain dry off BCS over the dry period. The cows remained on their respective diets until approximately one week before calving in mid-February.

Offering animals higher allowances of kale, silage and fodder beet in-situ resulted in a higher BCS change over the study period although not as high as that achieved on grass silage indoors (Table 2).

Table 2. Effect of winter forage and allowance on animal performance parameters

Allowance	High			Low		
Forage	Fodder beet	Kale	Grass silage	Fodder beet	Kale	Grass silage
Dry period						
Liveweight gain	69	54	61	25	25	42
Body condition score gain	0.37	0.25	0.61	0.07	-0.06	0.09
Subsequent performance for first 8 weeks in milk						
Milk solid yield (kg/day)	2.16	2.02	2.07	2.15	1.89	1.89
Liveweight loss (kg)	127	119	94	103	114	75
Body condition score loss	0.40	0.31	0.22	0.32	0.31	0.23

Offering kale without fibre

To date, it has been recommended to supplement animals grazing forage brassicas with a source of dietary fibre such as silage or straw which is a very significant cost and hassle in the system. The requirement for fibre is to maintain rumen function as brassicas have relatively low levels of fibre and high levels of rapidly available carbohydrate which, in theory, could induce acidosis in ruminants. However, the requirements for fibre are based on data from total mixed ration studies which are likely different to crops grazed in-situ. Much more saliva is produced in harvesting forage crops which has the effect of buffering the rumen. A recent short-term Moorepark experiment evaluated the effects of different levels of kale up to 100% of the diet and found no negative effect on rumen function (Table 3) but did find a 20% reduction in total DM intake where 100% of the diet was kale. However, kale is, on average, 15% higher in energy than silage resulting in the reduced effect on energy intake being very small. As part of the current experiment, outlined earlier in Emer Kennedy's paper examining the impact of a 100% kale diet on the performance of yearling heifers, is being evaluated, compared to heifers offered diets of kale plus silage or 100% silage diets of varying silage quality.

Table 3. Effect of four dietary proportions of kale: grass silage on dry matter intake and rumen pH

	Kale: Grass silage ratio			
	100:0	85:15	60:40	0:100
Kale DMI kg/day	7.32	6.35	4.90	-
Grass silage DMI kg/day	-	1.71	3.28	8.87
Total DMI kg/day	7.32	8.06	8.18	8.87
Mean rumen pH	6.26	5.91	6.32	6.32

Growing forage kale

For best results:

- Sow early (June) for maximum winter DM yield (10 – 12 t DM/ha) at 4.5 kg/ha seeding rate (direct drill), sown at less than 2cm depth.
- Delaying sowing beyond 20 June reduces DM yield by 40%. Very early sowing (before 20 May) may increase lignification or reduce digestibility.
- Provide adequate soil fertility, especially potassium and nitrogen (soil index).
- Monitor crop in early stages of growth for butterfly, aphid and slug damage; control with pesticide if needed.
- Do not grow forage kale or other brassicas on the same area for more than two years in every five, to prevent weed infestation, disease (clubroot) and reductions in forage DM yield.
- Varieties include: Maris Kestrel, Caledonian, Keeper, Prover, Gunner

Growing forage rape

For best results:

- Sow early (August; catch crop after winter/spring cereal) for maximum winter DM yield (5 – 7 t DM/ha) at 6.5 kg/ha seeding rate (direct drill), sown at less than 2cm depth.
- Delaying sowing from 1 August to 31 August reduces DM yield by 74%.
- Provide adequate soil fertility, especially potassium and nitrogen (soil index).
- Monitor crop in early stages of growth for butterfly, aphid and slug damage; control with pesticide if needed.
- Do not grow forage rape or other brassica on the same area for more than two years in five , to prevent clubroot.
- Varieties include: Stego, Interval, Emerald, Hobson, Swift.

Guidelines for feeding kale

The most important decision to make when break feeding is to offer the correct amount to the herd each day (i.e., size of the 'break'). Getting the break size wrong leads to a) underfeeding (loss of body condition) or b) overfeeding and poor utilisation of crop.

Gradually introduce brassica crops to ruminents over a period of at least 7-10 days. This allows adaptation by rumen microbes to the new diet and reduces risk of other problems, including nitrate toxicity, acidosis etc. Monitor cows closely during the adaptation period and remove poor performing cows from the mob.

Mineral supplementation

Mineral supplementation to animals grazing brassicas is essential. Typically, brassicas provide adequate amounts of calcium (Ca), sodium (Na) and potassium (K) but phosphorus (P) and magnesium (Mg) concentrations are usually marginal (Table 4). However, brassicas contain mineral antagonists which inhibit the uptake of minerals from the herbage. Brassicas contain two types of sulphur containing compounds: 1) S-methyl-cysteine sulphoxide (SMCO) which is known to cause anaemia in ruminants (avoid feeding flowering plants and frosted crops) and 2) glucosinolates which compromise the absorption and utilisation of iodine in cattle. In addition, brassicas, especially kale, do not supply adequate amounts of copper per kilogram of plant because of low herbage concentrations which may reduce body growth and thus productivity. Furthermore, availability of copper is suppressed due to high sulphur concentrations within brassicas. Finally, selenium is important for immune function. High concentrations of calcium decreases absorption of selenium and brassicas rich in calcium concentration may reduce selenium concentrations. Therefore, it is essential when utilising brassicas in-situ that minerals (copper, iodine and selenium) are supplemented to ensure the health and performance of the heifer.

Table 4. Mineral composition (g/kg DM unless otherwise stated) of kale, grass silage and dietary heifer requirement

Mineral elements	Kale	Grass silage	Dietary heifer requirement[1]
Calcium	11.70	6.10	4.10
Phosphorus	3.81	2.80	2.30
Magnesium	1.68	1.33	1.10
Potassium	38.70	27.60	4.80
Sodium	1.72	3.16	0.80
Sulphur	4.90	1.50	2.00
Copper (mg/kg DM)	3.42	6.50	10.00
Iodine (mg/kg DM)	0.15	0.30	0.30
Selenium (mg/kg DM)	0.19	0.03	0.30

[1]Adapted from NRC (2001), assuming a 12 month heifer at 300 kg liveweight

There are a number of options available to farmers when administering minerals to heifers utilising brassicas in-situ. These include: 1) mineral bolus, 2) mineral buckets, 3) mineral injection and 4) administration of minerals in the water trough. The heifers utilising kale on the Moorepark experiment this winter received a Tracesure – I mineral bolus at the start of the experiment to supply iodine, selenium and cobalt over a 3-month period. Furthermore, the heifers had also received a copasure (copper) bolus six months prior to the experiment.

Teagasc/Dairygold milk quality programme

Don Crowley[1] and Tom Weldon[2]

[1]*Teagasc, Advisory Services, Dunmanway, Co. Cork;*
[2]*Teagasc, Moorepark, Fermoy, Co. Cork*

Summary:

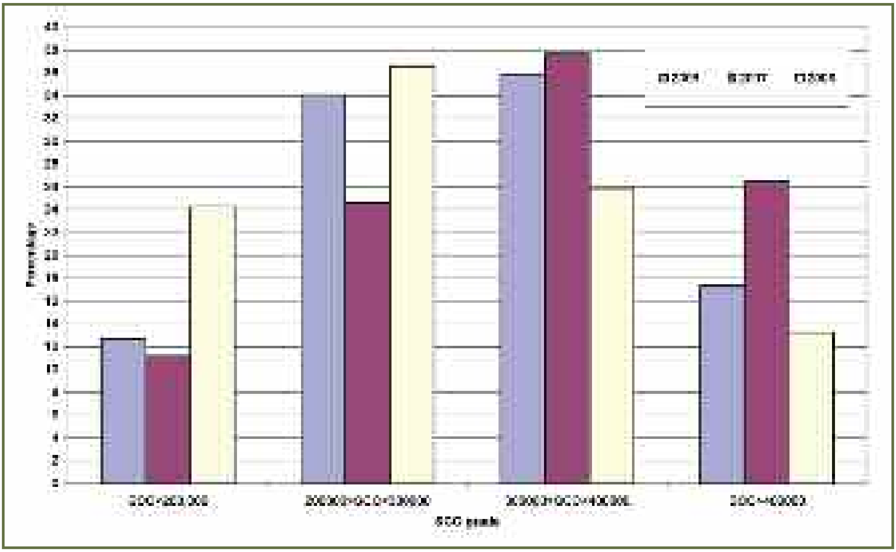
- A Teagasc/Dairygold joint initiative to combat increasing bulk cell count problems has been running for two years and has delivered improvements in SCC levels at farm and co-op level as well as reducing the incidences of mastitis.
- To maintain low SCC and mastitis levels, the every day milking routine, at a minimum should involve wearing milking gloves, effective post-milking teat spraying/dipping of all cows, and annual servicing of all milking equipment.
- In the face of a challenge i.e., bulk cell count reading of >250,000 or incidence of mastitis greater than three cases per 80 to 100 cows in a 2-week period the following regime should be implemented until the problem is under control. Wear gloves, pre-spray and dry wipe all cows with paper towel, disinfect clusters after clinical cows, and post-spray all cows after milking. Also have milking parlour assessed.
- Milk recording and utilisation of the data obtained from same is also an essential element in combating poor udder health.

Introduction

In 2006, Teagasc and Dairygold implemented a joint programme to improve Somatic Cell Counts on Dairygold farms. The aim of the programme was to introduce a comprehensive farmer friendly procedure to tackle rising SCC counts and increased incidences of mastitis. The programme has delivered significant on-farm improvements and on-going improvements in SCC for the co-op as a whole, contrary to national trends.

Figure 1 represents all farmers visited in 2007, and compares their results in 2008 to their 2007 and 2006 values – mean value for the year. Data presented is from January to October each year. This bar chart illustrates the programme has delivered results both at farm level and to Dairygold Co-op. There has been a significant improvement among herds with increases in the proportion of herds falling into 'low' cell count categories and a reduction in those falling into 'high' cell count categories.

Figure 1: Farmers visited 2007 compared with performance in 2008. The 2006 figures are included also for comparative purposes.



Furthermore the number of farmers with SCC values of less than 200,000 has increased from 11% to 24%. In the category from 200,000 to 300,000, it increased from 24% to 37% of farmers. Farmers ranging from 300,000 to 400,000 SCC have reduced from 36% to 26%. Finally, the number of farmers in the over 400,000 SCC have fallen from 27% to 13% of total. Therefore across all categories there has been significant progress in reducing SCC levels.

What is the cost of mastitis?

When all aspects have been accounted for, each case of mastitis (i.e., milk lost, cull rates, treatment costs, reduction in yield potential, bonus losses etc) it is estimated that the cost can be as high as €590 per case (source UCD, Vet College). It is important to remember the hidden costs as well as the visible costs in relation to mastitis.

Typical scenarios encountered

There are three common problematic scenarios that we encounter time and time again on this programme:

Scenario 1. A farmer experiencing high cell count (sub-clinical mastitis) with no cases or very few cases of clinical mastitis.

Scenario 2. A farmer with a cell count of 150,000 to 250, 000, but experiencing a high incidence of clinical mastitis. (i.e., clots visible as well as swollen quarters).

Scenario 3. A very low cell count herd i.e., <100,000 but experiencing a high level of E.Coli mastitis specifically.

Scenario 3 is the least frequent; primarily associated with housing. E.Coli mastitis is an environmental mastitis, and typically the solution involves improving house management and cubicle hygiene. Keep cubicles dry and clean - regularly disinfect cubicles. Increasing the frequency of automatic scrappers, adjusting diet to ensure dung is drier, and the application of a liquid cream dip e.g., 'Udder Gold' or 'Hyperdip' etc. for a period of 1 to 2-weeks tends to provide immediate and excellent results.

Scenarios 1 and 2 are the most common situations we observe at farm level. These scenarios result mainly due to poor milking technique, inadequate infection control and/or malfunctioning milking equipment.

Before outlining how we suggest farmers approach a problematic situation we first need to outline what we feel is necessary to implement as routine:

- Clean disposable gloves should be worn at all times to minimise the spread of infection.
- Pre-spray and dry-wipe any dirty cows with paper towel - do not wash with water.
- Check cows (fore-milk) to identify cows with mastitis (<u>legal obligation</u>).
- Post-spray all cows post-milking, ensure every teat is covered to enable proper disinfection of teat post-milking.

As a rule of thumb 15 mls of teat spray per cow per milking should be applied post milking. (e.g., 50 cows × 15 mls = 750 mls. i.e., 1.5 litres of teat spray should be used per day).

Recommendations in the face of challenge i.e., Scenarios 1 or 2 above:

In the face of a challenge the priority is to stop the spread of infection i.e., protect the low cell count cows in the herd. Identify the areas of spread and eliminate these as a potential source of infection. The following elements should be incorporated into the daily milking routine outlined until the outbreak has been overcome:

- Pre-spray all cows with teat spray and dry wipe with paper towel. **Always dry-wipe cows when pre-spraying especially when using an Iodine based dip to avoid milk contamination**. This disinfects all teats and reduces the spread of infection via hands when fore milking and via liners when clusters are changed from cow to cow.
- Disinfect clusters after problem cows in a per acetic acid solution (20mls per-acetic acid e.g., serpent to two gallons of water). This solution should be changed after 15 dips.

This routine will usually need to be maintained 2 to 3-weeks (or maybe more in the case of a Staph. aureus infection), at this stage the challenge has reduced and cell counts drop.

The investigative process

The first aim is to establish what the financial cost of the outbreak is. It surprises farmers when they realise what mastitis is costing their business. Records from co-op, milk recording, individual cell counts and treatment data are analysed to assess the degree of the problem. Identification of bacteria, evaluating teat end and teat condition gives an indication as to the possible cause of the mastitis problem. During an investigation milking practices are assessed, stray voltage is checked and all milking equipment is tested.

It cannot be over stated the value of good accurate records. Ideally ICBF milk recorded data with access to herd plus will give the most in-depth picture of the herd. If this is not available, cell count tests should be carried out on all cows in the herd at least three times 3 to 5-weeks apart. All cases of mastitis should be recorded. This information will help identify chronic infected cows in the herd, cows for culling, it will give an indication as to the health status of the herd and it will help formulate a plan to reduce SCC in the herd.

With an infectious disease in a herd it is important to know what bacteria is the cause of the problem (e.g., Staph aureus, strep uberus, strep agalactiae etc). The identification of bacteria will give a guide as to the likely source of the problem. To identify bacteria involved we recommend taking samples from a minimum of three high-cell-count cows and one sample from the bulk tank. These samples will give a good picture of what is happening in the herd. These should be taken as aseptically (cleanly) as possible.

Poor milking procedures

Milking procedures vary widely from farm to farm. From our on-farm investigations poor milking procedure is one of the single greatest contributors to high mastitis incidence and SCC levels in a herd. Poor preparation of cows prior to milking is a common problem and is a source of cross infection. Components of poor procedures commonly observed by us at farm level include: no teat preparation, the use of unhygienic cloths to prepare cows, washing of cows with no drying, poor application of post-milking spray/dip, removing clusters under vacuum and over milking. Infection is commonly spread from cow to cow with these practices.

Milking equipment and teat condition

Faulty milking equipment is again one of the greatest offenders in the fight against mastitis/poor udder health. One of the first areas to be assessed is the teat openings and general teat skin condition. The teat opening is scored based on the degree of damage caused to the teat end during the milking procedure, this condition is called hyperkeratosis. The condition of the teat is scored based on a score card from 1 to 5. Damaged teat ends increase the cows vulnerability to bacterial challenge.

There are a number of areas that affect teat end condition, over milking, excessive vacuum, faulty pulsation, removing clusters under vacuum and blocked air bleeds.

A milking machine needs to be serviced at least once per year, liners should be changed every 2,500 milkings. Common areas at fault include high operating vacuum levels, inadequate vacuum reserve, faulty pulsation settings, wrong fall in milk line, milk entries not in top1/3 of pipe, receiver jar flooding and poor quality rubber tubing i.e., old and frayed tubing are common areas of neglect.

Stray voltage

Perhaps surprising to many, this is a problem in a small minority of cases (~5% of cases we have seen). It is important to have your parlour bonded correctly. Your meter box should be located in the dairy. Fencers should not be located in the dairy.

Other stress issues include slippery floor entrances and exits, poor design of collection yards, poor alignment in parlours and lack of natural light in parlours.

Treatment of clinical mastitis

Treatment of clinical mastitis (clots plus swollen quarter) and sub-clinical mastitis (no clots but a high cell count) during the lactation period can be very varied in terms of success. In many instances response to treatment will only give a short term cure, thus you see fluctuating cell counts from month to month. The main issue in treating clinical cases of mastitis is farmers not carrying out full course of treatment.

Research work from Moorepark, the US and Britain suggest better cure rates are obtained, when using injectable antibiotics in conjunction with intramammary tubes for three days and up to one week. This heavy course of treatment will help prevent chronic infected cows from occurring. ***Consult your veterinary surgeon for appropriate treatment for your farm***. Moorepark has found that where farmers have used the CMT test kit to monitor treatment regimes and continued treatment for a longer period a clinical cure and sub-clinical cure have been achieved.

If chronic cases establish then treatment of these cows is futile. Cows with a cell count of over one million, where the age profile is high and they continually present with repeat cases of mastitis are chronically infected, and these cows should be culled.

Dry cow therapy can have a dramatic positive effect on somatic cell counts in dairy herds. The dry period offers a significant opportunity to administer long acting antibiotics with or without a sealer to kill infections within a quarter in preparation for the subsequent lactation. Intramammary infusions can last up to 54 days post-insertion. The use of non-antibiotic dry cow tubes may be considered where cows have low cell counts (less than 150,000 cells/ml). ***Hygiene is paramount when inserting tubes to avoid new infection***.

Conclusions

Mastitis control is a multi-factorial issue and requires constant vigilance. It is vital to maintain a good milking routine. Maintain good accurate records. Have a plan of action when a problem arises. Service your parlour regularly and monitor teat condition to verify proper machine function and proper milking practices are carried out.

Acknowledgements

We would like to thank Liam O'Flaherty, Noel Coughlan (Dairygold Management), Maeve O'Connor, John Cronin, Jack Cahill, Frank O'Flynn and William Ryan (milk advisors with Dairygold) for their assistance with the programme, Dermot McCarthy, Billy Kelleher, Liz Duffy, Tom Downey, Ger McMahon and John Maher (Teagasc) for their help and backup in developing the programme. We would also like to acknowledge the research and backup provided by Eddie O'Callaghan, Dave Gleason and Bernie O'Brien of Moorepark.

To the monitor farmers and farmers we have worked with, we convey special thanks.

Practical steps to improve milk hygiene

David Gleeson and Bernadette O'Brien
Teagasc, Moorepark Dairy Production Research Centre, Fermoy, Co. Cork

Summary
There are three critical control points or potential contamination points within the milk handling system on-farm that can influence milk quality from a hygienic perspective:

- External surface of cow's teat – hygiene: present clean cow for milking
- Milking machine – hygiene: effective washing routine
- Bulk tank – temperature and hygiene: correct storage temperature and washing.

Introduction

With milk payment systems influenced by quality, the goal must be to produce optimum quality milk. This is a constant challenge. Global dairy markets and worldwide consumer preoccupation with food quality and safety will continue to place more pressure on farmers to provide high quality and safe dairy products. The quality standards acceptable in the past may no longer be acceptable, e.g., hygiene legislation of 100,000 cells/ml total bacterial count (TBC) was adequate previously, whereas, now it is necessary to focus on the marketing standards nearer to 10,000 cells/ml TBC. Significant changes continuously impact upon the demand, production and supply of high quality milk, i.e., 1) milk standards required by the processors have increased; 2) herd size is increasing and 3) availability of skilled labour has reduced.

In order to achieve optimum quality milk, the production of quality milk must be considered a priority. All milkers on the farm should be involved in decisions affecting milking procedures. Training should be provided for milkers. Periodic observations of milking should be made and feedback given to the milkers. Goals should be set for milk quality (less than 200,000 SCC, and less than 5,000 TBC) and results reviewed by charting performance measures of milk (if it is not measured, it will not be improved).

Cow cleanliness together with daily cleaning and disinfection of all milking equipment are critical in producing high quality milk.

An effective dairy hygiene programme incorporates three individual components:

- Pre-milking
- Milking plant
- Bulk tank.

Pre-milking

Bacteria and organic matter not removed from the teat surface before machine attachment will end up in the milk, thus it is important to maintain the teats as clean as possible. Teats should be clean, dry and free of residue. The following management practices assist in improving cow presentation:

- Clipping of tails post-calving, mid-lactation and drying-off (minimum)
- Clipping of udders post-calving and mid-lactation (minimum)
- Entry and exit to paddocks, approach roads to the dairy and the collecting yard should be maintained in a clean condition and without surface water
- Cubicle beds should be maintained clean and dry
- Any remaining dirt on teats to be removed prior to milking. The lowest TBC and sediment levels are achieved when teats are washed and dried prior to cluster application. When teats are washed, it is absolutely necessary that they be dried, preferably with individual paper towels.

Post-milking teat disinfection is effective against contagious pathogens, e.g., S. aureus and S. agalactiae and reduces infection by these organisms by about 50%. Post-milking teat disinfection should be applied throughout the lactation to all teats of all cows as soon as possible after every milking. For maximum effectiveness, the teat spray should be applied from directly underneath the tips of the teats, not sprayed from the side.

Milking plant

Cleaning milking equipment removes residues from internal milk contact surfaces to avoid build-up of organic or mineral deposits that provide sites for bacterial growth. The deposits may be identified by texture and colour (Table 1). The formation of a deposit may be linked to a specific cleaning product or more likely the recommendations not being adhered to when using the product. It is important to use cleaning products from a reputable supplier. The cleaning system adopted may depend on the parlour size and hardness of the local water supply. Typical residues that occur in milking machines are organic residues such as lipids (fats), proteins, carbohydrates (sugars) which are removed by the detergent wash. For example chlorine is necessary for the removal of protein deposits. Mineral deposits such as iron, calcium and magnesium are removed by descale hot wash (acid wash). The descale wash should be carried out weekly especially in hard water situations. If organic and mineral deposits are not removed, they may serve as a nutrient and breeding ground for micro-organisms. Sanitising of a milking plant is carried out for the purposes of killing micro-organisms that may be present on surfaces.

Table 1. Identification of deposits in milking machines

Deposit	Diagnosis	Cause
Fat	Soft and greasy	Low temperature washing, poor rinse after milking, ineffective detergent
Protein	Hard brown film	Poor washing circulation, ineffective chlorine detergent
Iron	Hard orange film	Inadequate descaling, low acid concentration

Sediment can also be a significant problem in milk. To assist in the reduction of sediment, a new filter sock should be put in place before each milking and removed before the washing procedure. It is most important to follow the washing instructions specific to the system in place. It must be ensured that correct wash solution volumes, temperature, circulation time and concentrations are adhered to. A suitable wash procedure may be as follows, depending on the milking system in place.

Three cleaning routines for milking plants are outlined. In larger parlours with additional fittings such as milk meters, it is necessary to carry out at least one hot circulation cleaning per day (Option 1). For smaller plants without additional milking equipment a cold circulation cleaning system (Option 2) which uses a caustic detergent mixed in cold water is considered satisfactory.

Option 1 – Daily: hot circulation cleaning

After each milking

1. Wash outside of clusters and attach to jetters.
2. Rinse plant with 13 litres cold water per cluster.
3. Dissolve an approved alkaline chlorine detergent-steriliser at the recommended use rate in hot water (75-80°C) allowing about nine litres of solution per cluster.
4. Circulate the solution for 10 minutes having allowed the first five litres to run to waste. If the detergent is recommended for re-use, return all the solution to the wash trough and retain for the second daily wash.
5. Add hypochlorite at 14 ml per 45 litres of rinse water. Rinse the plant with 13 litres of this water per cluster to remove the detergent residue.
6. Ensure that milklines are drained completely before milking.

Regular weekly acid wash routine

Circulate an approved acid detergent or milkstone remover at the recommended concentration, instead of the alkaline chlorine product.

Option 2 – Daily: cold circulation cleaning

After each milking

1. Wash outside of cluster and attach to jetters.
2. Rinse plant with 13 litres cold water per cluster.
3. Dissolve an approved caustic detergent in cold water. Use at 227 g/45 litres allowing about nine litres of solution per cluster.
4. Circulate the solution for 10 minutes having allowed the first five litres to run to waste. Return all the solution to the wash through and retain for the second daily wash.
5. Before milking, add hypochlorite at 14 ml per 45 litres of rinse water. Rinse the plant with 13 litres of this water per cluster to remove the caustic detergent residue.
6. Ensure that milklines are drained completely before milking.

Weekly descale wash routine

1. Circulate a 1% solution of approved milkstone remove (acid detergent) 560ml or 454g/45 litres for 5 to 10 minutes, preferably in hot water at about 60°C and flush to waste with cold water.
2. Follow by circulating caustic detergent in hot water at 227g/45 litres to which 168ml agricultural grade hypochlorite or equivalent chlorine source has been added. Allow 9 litres per cluster. After 10 minutes flush plant with 13 litres cold water per cluster.

Option 3 - Automatic machine washing

Operate the system as recommended by the manufacture and installation guidelines.

Note:

- Check that an adequate quantity of detergent steriliser (as recommended by the manufacturer) is used weekly. Some products can crystallise or become more viscous over time. This may result in a lower level of the product being drawn through the milk lines for washing.
- Use a descaler once weekly. Weekly washes with descaler should be recorded on a wall chart in the dairy to ensure regularity.
- Always use the detergent steriliser product that is recommended by the manufacturer/ installer of the automatic washing system
- Automatic washers should be serviced annually.
- Check temperature of hot washes periodically to ensure that water heaters are functioning properly.

Bulk tank

Rapid and efficient milk cooling is essential for preserving milk quality. Milk leaves the udder at approximately 35°C and this milk must be cooled quickly. Milk retains a natural resistance to bacteria immediately after extraction, but only rapid cooling to a storage temperature of around 4°C to 6°C, prevents or minimises further micro-organism growth. The use of plate coolers reduce the milk temperature before entering the bulk tank. This helps in the rapid cooling process and in reducing electrical running costs. It is not only the storage temperature that is important; the cooling time to reach storage temperature, normally 4°C, is also critical. Bulk milk coolers have been specially designed to cool the milk to 4°C within a specified time period. It is vital to recognise that cooling is a complement, not a substitute, for hygienic working conditions. Avoiding infections through good hygiene practices, and cooling the milk as soon as possible after milking, combine to ensure high milk quality.

The guidelines for TBC target limits are for the milk to have a TBC of less than 1,000/ml as it leaves the udder, <3,000/ml as it leaves the milking machine and <5,000/ml in the bulk tank. The increase in TBC with duration of storage at different temperatures is shown in Table 2. If milk has a TBC of 5,000/ml initially and is stored at 4°C, then the TBC will increase to 10,000/ml after two days and to 100,000/ml after four days. Therefore, both storage time and temperature are important. This is also partly due to the blend temperature of the milk increasing for a period of time as additional milkings are added to the bulk tank. The guidelines for milk storage are as follows: 1) Fast cooling rate, this will also assist in avoiding high blend temperatures; 2) Accurate temperature control during storage (3-4°C) and 3) Excellent hygiene from teat to tank.

Table 2. Milk TBC as affected by duration storage at various storage temperatures

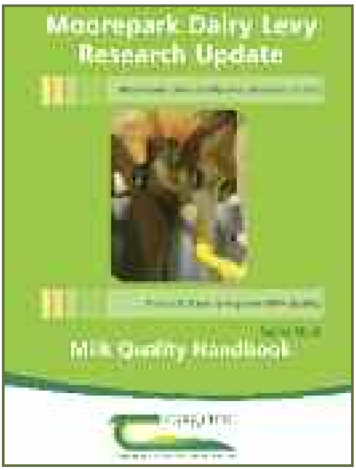
	Expected TBC after storage		
Milk storage temperature °C	**2 days**	**3 days**	**4 days**
2	5,000	15,000	50,000
4	10,000	30,000	100,000
6	30,000	100,000	1,000,000

Thermoduric bacteria

Thermoduric bacteria are those which are resistant to pasteurisation temperatures. Contamination of milk with one form of thermoduric bacteria is a potential problem for the shelf life of pasteurised milk and a potential food poisoning agent. This form is commonly found in soil and is most frequently found in milk during the grazing season, when the risk of teat contamination with the soil is greatest. A similar species of thermoduric bacteria causes gas blowing problems during the manufacture of some types of cheese. The major source of this bacteria found in the milk is silage feeding (particularly poor-quality silage). These thermoduric bacteria can then be found in the dung of animals consuming silage, and manure contamination of the teats then results in the bacteria being transferred to the milk. Therefore, the problems of thermodurics in milk arise due to either soil contamination of teats during pasture or bedding contamination of teats during winter, both of which can be reduced by good cow cleaning routines. The remaining type of thermoduric bacteria presents a risk of contamination of milk through deposits building up within the milking machine. This risk can only be corrected by appropriate machine washing routine including caustic detergent, minimum of weekly hot wash at 75-80oC and weekly descaling.

Milk quality handbook

Teagasc recently published a handbook providing guidelines and recommendations for the production of high quality milk on-farm. The handbook provides valuable information on all aspects of quality milk production. Techniques to achieve excellence in milk quality are detailed and specifically address the areas of SCC, TBC, thermoduric bacteria, and residues including iodine and trichloromethane and milk lactose content. The title of the handbook is 'Milk Quality Handbook – Practical Steps to Improve Milk Quality' and was edited by Bernadette O'Brien (Moorepark). This handbook has been sent to all milk purchasing outlets and is to be distributed to each milk producer (through the milk purchaser). It will also be of benefit to milk quality advisors, veterinarians and milking machine personnel.



Ongoing research

Current work involves investigating the effect of different teat preparation practices on milk quality. This work has been conducted in other countries but it is important that it be conducted under Irish weather, paddock and housing conditions. The issue of milk iodine levels is also being investigated, particularly in relation to iodine levels in feeds and feeding levels at various periods of the lactation.

"€uroMilk"- A team-based approach to on-farm mastitis and milk quality issues

Finola McCoy,
Teagasc, Moorepark Dairy Production Research Centre, Fermoy, Co. Cork

Summary
- Mastitis, both clinical and subclinical is a significant cost to the Irish dairy farmer.
- Lack of national control programme.
- Success of "milk quality teams" shown in other countries.
- Moorepark "€uroMilk" pilot project commenced November 2008.
- Action research studying farmer's perception of advisory services, their motivation for change and the sustainability of these changes.

Background

In Ireland, average bulk tank somatic cell counts have risen annually by 5,000/ml since the start of this decade. However, it is very difficult to quantify the extent of clinical mastitis incidence in Irish dairy herds as recording of clinical cases of mastitis is variable between farms. Ireland continues to have a low national level of milk recording when compared to other countries.

Mastitis, both clinical and subclinical, is costing the Irish dairy farmer. Clinical mastitis results in treatment costs, increased labour and discarded milk. A conservative estimate of the cost of a clinical case of mastitis is €56 and can be calculated as follows:

Antibiotics	€10
Discarded milk (20 litres/day X 6days=120 litres @ 30 cent/litre)	€36
Labour (42 min) (5min/milking x twice daily for 3 days of treatment) +(2min/milking x twice daily for 3 days of withholding milk)	€10

The cost of subsequent production loss and stress associated with treating infected cows, along with increased culling rates and mortality should also be considered. While difficult to quantify, this can be a substantial cost on many farms. Work from UCD estimated the total cost of mastitis (both clinical and subclinical, and including the "extra" costs referred to) as significantly higher (see paper Crowley and Weldon earlier in this booklet).

High SCC will result in reduced milk yields. USA data suggests that with each increase in SCC by 100,000 there is a 1.5% to 3% decrease in herd production. Herds with higher SCC also exhibit an increased risk of antibiotic residue violation because of their increased antibiotic usage.

Processing companies apply a penalty for milk supplied that does not comply with the EU regulatory SCC limit of 400,000/ml. In April 2008 Dairygold was the first milk processing company to introduce an incentive payment system, followed by Connacht Gold in August 2008. This is a bonus payment for suppliers that consistently produce premium quality milk i.e., bulk tank SCC <200,000/ml. Farmers that are constantly struggling with high bulk tank somatic cell counts are thus losing out on bonus payments as well as incurring penalties.

There is a wealth of knowledge available in relation to mastitis prevention and control. Many countries have used this information to develop national mastitis control programmes e.g., New Zealand and the Netherlands. In Ireland a farmer may seek advice in relation to mastitis or other milk quality issue from individual sources such as his dairy advisor, veterinarian, milking machine technician etc. Research data from the US has shown that the formation of "milk quality teams" has been successful in encouraging farms to adopt recommended management practices and improve communication between producers and dairy professionals. The idea of using a team-based approach to solving milk quality issues is one that the University of Wisconsin has explored with great commercial success. Their "MilkMoney" programme commenced in 2001 and has been instrumental in defining clear milk quality goals, creating clear action plans and adopting best management practices.

Moorepark "€uroMilk" project

"€uroMilk" is a recently established collaborative programme between Teagasc and Glanbia that commenced in November 2008. The first part of the programme is a pilot study which aims to investigate if a similar team-based approach would be effective in the Irish dairy industry. It is important to identify the challenges and logistical difficulties that may be encountered in the delivery of such a control programme e.g., communicating the idea to farmers, recruiting team-members, programme design, resources required etc. It will be invaluable to gain insight into the factors that motivate farmers to make management decisions and adopt changes. It is also important to learn if this change is sustainable. The programme will help us to understand how farmers perceive advisory services and what encourages or prevents the implementation of recommended control measures.

€uroMilk objectives:

1. To improve milk quality and reduce mastitis incidence on a pilot study group of 23 Irish dairy farms.
2. To investigate the possibility that a team-based, problem-solving approach could be successful on Irish dairy farms.
3. To investigate why some on-farm teams may work more successfully than others, using action research.
4. To investigate motivating factors for farmers and their response to support services in the dairy industry i.e. advisory services, veterinary services etc.

5. To increase collaboration between dairy industry stakeholders.
6. To upskill service providers (farm advisors, veterinarians, milking machine technicians, farm staff etc.) as necessary and encourage their involvement in mastitis control.
7. To develop a structured framework for mastitis prevention and control.
8. To identify programme areas that may need to be refined prior to national implementation.

Study outline

Twenty three dairy farmers are participating in the pilot programme. All farmers are milk-recording, Glanbia suppliers. All farmers have had an on-going issue with mastitis, either clinical or sub-clinical. Initially over 70 farmers were contacted following proposal by Teagasc advisors, Glanbia milk quality advisor and/or veterinary practitioners. From this, 23 farmers voluntarily registered for the programme. Each farmer has created their own “milk quality team” of at least three people. Team members include Glanbia milk quality advisors, Teagasc advisors, veterinary practitioners, milking machine technicians, nutritionists, farm staff and/or family. Each milk quality team will meet five times during nine months, at 6 to 8-week intervals. Each team has one co-ordinator who is responsible for arranging the meeting dates, communicating with all team members and recording meeting information.

The first team meeting involved analysis of the farm situation and associated challenges. Up to three farm-based targets were then set. These targets were quantifiable e.g., reducing SCC from 400,000 cells/ml to 250,000 cells/ml, reducing new cases of mastitis to 25 cases/100 cows/annum etc. All targets are time bound. Action tasks aimed at reaching the targets as well as the team member responsible have been put in place. At subsequent meetings a similar procedure will be followed whereby further action tasks will be drawn up. At the end of the project, performance data gathered during the course of the programme will be analysed.

As mentioned, one of the objectives of the programme is to learn more about farmers motivation for change, the sustainability of these changes and whether we as advisors can present knowledge in a more “palatable” fashion. This is done by carrying out “action research” which is a process of continuous monitoring and refinement. During the lifespan of the project regular consultations with farmers and participation at team meetings take place. This is being performed by a social scientist from UCD. Recommendations arising from the data gathered are subsequently fed back to the programme facilitator to improve the way in which the project is conducted.

How to recognise and control BVD and IBR

Ríona Sayers
Teagasc, Moorepark Dairy Production Research Centre, Fermoy, Co. Cork

Summary

- Non-regulated Infectious diseases such as BVD and IBR are resulting in significant economic losses on Irish dairy farms.
- The impact of such diseases can be reduced by implementing an on-farm health plan incorporating biosecurity, diagnostic testing and strategic vaccination.
- Greater awareness of infectious disease control amongst dairy farmers and implementation of the combined approach of biosecurity, diagnostic testing and vaccination will lead to reduced national prevalence of these economically relevant infectious diseases.

Introduction

BVD (Bovine Viral Diarrhoea) and IBR (Infectious Bovine Rhinotracheitis) are viral diseases of cattle. They are relatively new diseases in Ireland, initial reports of their existence date back to the late 1980's, early 1990's. Both diseases are highly infectious and cause significant economic losses on dairy farms. The prevalence of BVD and IBR in Ireland is unknown, although it is estimated that approximately 80-90% of Irish herds have been exposed to BVD virus. The prevalence of IBR is likely to be lower, but does exist in an unacceptably high proportion of herds. The impact of these diseases in terms of farm profit and animal welfare should not be underestimated, and control programmes for both diseases must be initiated in order to increase the health status of the national herd as a whole, and to limit future on-farm losses. Introduction and implementation of on-farm health management on Irish dairy farms is now necessary in order to reduce the impact of infectious diseases such as BVD and IBR.

BVD

BVD is caused by bovine viral diarrhoea virus (BVDv). It is a highly contagious disease and direct animal contact is the most efficient method of BVD virus transmission. Two types of BVD infection exist:

- Transient viral infection (TI). This type of infection occurs when a previously unexposed healthy animal (naïve animal) becomes infected with BVD virus. This infection only lasts for a 2-week period (approximately) during which time the infected animal will shed virus and thus is a source of disease (see below). The majority of these transient infections do not result in clinical signs. On occasion, however, a severe transient infection (severe acute BVD) can prove fatal. Following a transient infection an animal develops long-lasting immunity.
- Persistent viral infection (PI). This type of infection can only be generated by infection of an unborn calf between months two and four of gestation

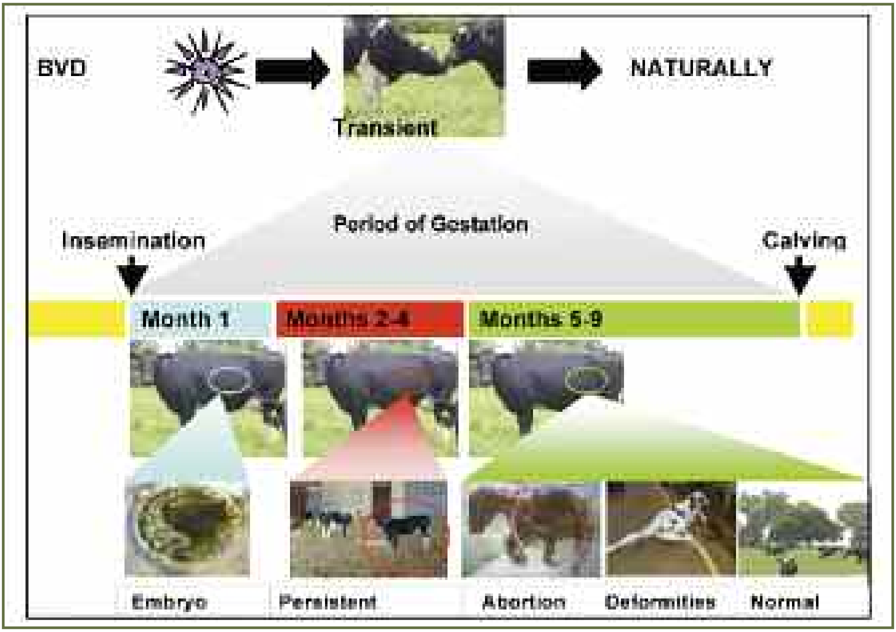
(Figure 1) i.e., calves are born persistently infected and will carry and shed BVD virus for their entire lives. PIs, therefore, can only be generated in-utero and cannot develop from previously healthy animals. It should be noted that PIs cannot be cured and will allow BVD virus to persist in a herd. PI animals can look perfectly healthy or may look noticeably below target weight.

Both transient and persistently infected animals shed virus particles in all bodily secretions such as nasal and oral discharges, tears, milk and semen. Persistently infected animals shed significantly higher levels of virus than transiently infected animals and as such pose a greater threat to the health status of a herd. The key to control of BVD, therefore, is culling of PIs as these act as the constant source of virus in a herd. **PI removal is an essential step in the control of BVD**.

Indications that BVD exists in a herd include:

- Poor fertility (conception rates, % empty), having ruled out other causes
- Poor calf health i.e., unprecedented or undeserved level of calf scour and/or pneumonia
- Increased number of abortions, stillbirths, weak calves, and/or deformities
- Occurrence of severe acute BVD
- Occurrence of fatal mucosal disease. This is only possible in persistently infected animals and is characterised by very severe diarrhoea and rapid deterioration of the affected animal. This can be accompanied by respiratory illness, lameness due to inter-digital ulceration and reduced appetite due to ulceration in the mouth.

Figure 1: Possible outcomes of BVD viral infection



From Figure 1, it can be seen that if the dam becomes infected with BVD for the first time during gestation, there are a number of possible calf outcomes depending on the time of gestation that the exposure occurs. If exposure and transient infection of the dam occurs during month one of gestation, embryo death will result with the dam returning to heat. If infection occurs during months two to four of gestation, a persistently infected (PI) calf will result. If infection occurs during months five to nine of gestation, a number of possible outcomes are possible and include abortion, calf deformities such as extra or missing limbs, lack of anal development and calves with poor balance. Infection of the dam at this time can also result in the birth of perfectly healthy off-spring.

Direct animal contact is the most efficient method of viral transmission from one animal to another although it should be remembered that indirect transmission by dirty footware, contaminated housing, veterinary equipment and farm visitors can also occur, although of lower risk. Following diagnostic testing, if a PI is found in the herd, **IT SHOULD NOT BE SOLD**. A persistently infected animal cannot be cured and should be immediately culled. Under no circumstances should a known PI be kept in contact with the breeding herd or the cycle of BVD infection will continue. The presence of a PI in a herd will also seriously undermine the effectiveness of BVD vaccination programmes and vaccination should not be viewed as the sole method of BVD control. Vaccination must be combined with PI removal and biosecurity to optimise BVD control. It is possible to accurately test for PIs using blood samples and such a testing programme should be initiated should the possibility of PIs in a herd be indicted by bulk milk antibody testing and blood sampling of weanlings for antibodies to BVD. A step-by-step guide to BVD control is outlined in a later section.

IBR

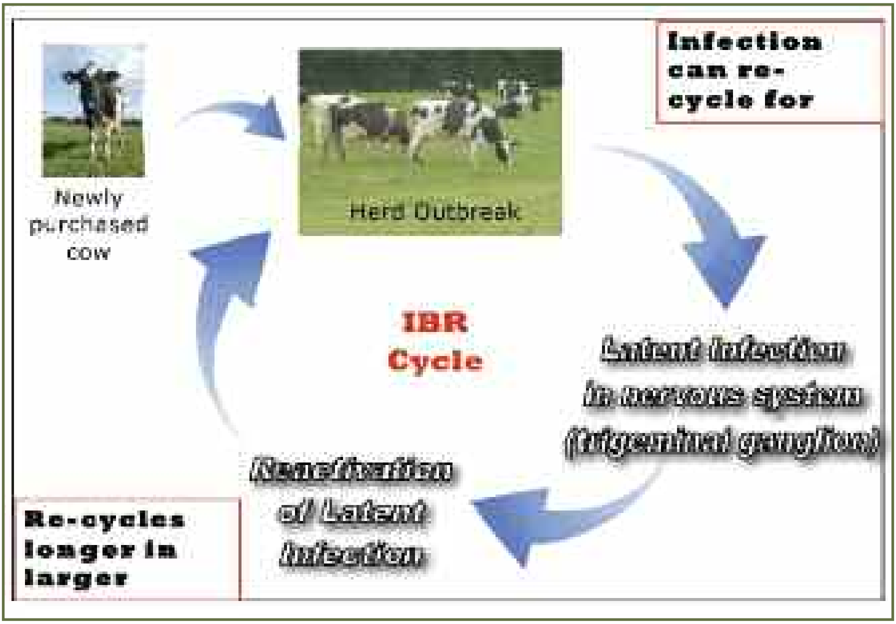
IBR is caused by Bovine Herpes Virus 1 and is a highly contagious viral disease of cattle. Direct animal contact is the most efficient method of IBR virus transmission with nasal discharges from infected animals containing large amounts of virus. Animals that have become exposed to the virus in their lifetime can become carriers of the disease and as such pose a threat to the dairy herd. Stress re-activates latent infections in carrier animals that then infect additional animals in the herd and maintain the cycle of infection (Figure 2). As with BVD indirect transmission can also occur although of lower risk.

IBR manifests itself in two ways in an infected herd:

1. The initial outbreak – this is characterised by;
    - Sudden milk drop and high fever
    - Nasal discharge – sore, inflamed, crusty nose
    - Sore and cloudy eyes (conjunctivitis)
    - Severe pneumonia due to secondary bacterial infections
    - Abortions in the second half of pregnancy
    - Increase in calf pneumonia.

2. Secondary outbreaks – these are not as severe as the initial outbreak and are characterised by;
   - Occasional abortions in second half of pregnancy
   - Increased level of calf pneumonia.

Figure 2: The infection/re-infection cycle of IBR



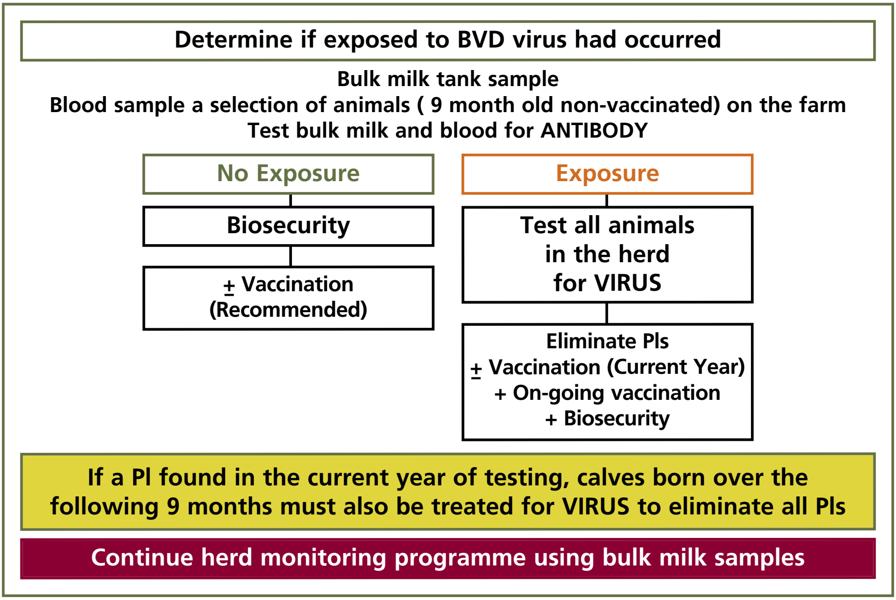
Following diagnostic testing, if latently infected carriers are detected, they should be sold for slaughter only. IBR carriers will shed the virus intermittently over their lifetime and will place a herd at risk of continuing IBR outbreaks. As the number of potential carriers in a herd may be high, immediate culling of carrier animals is often not an option. In this case, the priority is to protect new animals entering the herd (replacements, purchases) using bi-annual vaccination. Such a vaccination protocol combined with annual diagnostic testing will lead to eventual elimination of IBR from the herd through natural culling of carrier animals. It should be noted that an initial outbreak IBR can be controlled, and its impact reduced, by use of a modified-live vaccine. These vaccines are designed to function in the face of an outbreak and to protect against generation of new carrier animals. If an IBR outbreak is suspected, the importance of rapid vaccine intervention cannot be stressed highly enough.

Pedigree breeders should be aware of the fact that candidate bulls for AI will be rejected if they test positive for antibodies to IBR. There is no distinction made between antibodies to vaccine and antibodies to the actual IBR virus for the purposes of screening bulls for performance testing. Such animals should NOT be vaccinated, therefore, if intended for performance testing and should be isolated immediately from high risk animals on the farm if an outbreak has occurred. It should also be remembered that it is possible for modified-live vaccines to be transmitted from one animal to the next, resulting in antibody generation in bulls that may not have been vaccinated directly, again resulting in exclusion from AI programmes. If producing bulls suitable for performance testing, ensure you discuss IBR control plans (with particular regard to vaccination) in detail with a vet knowledgeable in this area.

Control of viral disease in dairy herds

Disease control in dairy herds should employ a combination of biosecurity, vaccination and diagnostic testing. This combined approach allows determination of the health status of a herd. Many EU and non-EU countries (Netherlands, UK, Australia, New Zealand) are now implementing such disease control programmes utilising bulk milk sample testing in centralised laboratories to routinely screen herds, monitor their disease status, and promote implementation of appropriate biosecurity strategies. With the increasing prevalence of diseases such as BVD and IBR in Ireland, dairy farmers need to take such practices on board in order to maintain competitiveness. Figures 3 & 4 outline the steps that should be taken to determine if exposure to BVD or IBR has occurred in a herd and the necessary follow-up steps to be taken should viral exposure be indicated. Briefly, it is first necessary to determine viral exposure by testing a bulk milk sample and blood samples from a selection of 9-month-old (approximately) unvaccinated weanlings for ANTIBODIES to the virus of interest. If exposure is indicated by a medium to high level of antibody in the bulk milk sample combined with any or all of the weanlings testing positive for ANTIBODIES, control measures have to be put in place. These control measure include whole herd testing to identify persistently infected (PI) animals, as in the case of BVD, or latently infected animal as in the case of IBR. As the number of PIs identified in a herd is usually low (1-3 in a 100-cow-herd), immediate culling of these animals should be undertaken. The number of latently infected IBR carrier animals in a herd can be high and so a combination of vaccination and diagnostic testing is the most economical option to control and eventually eliminate IBR from a herd (Figure 4). All vaccination and testing programmes must be supported by a minimum level of biosecurity to ensure continued BVD and IBR control and prevent re-introduction to the herd.

Figure 3: Monitoring and control of BVD in a dairy herd



Biosecurity

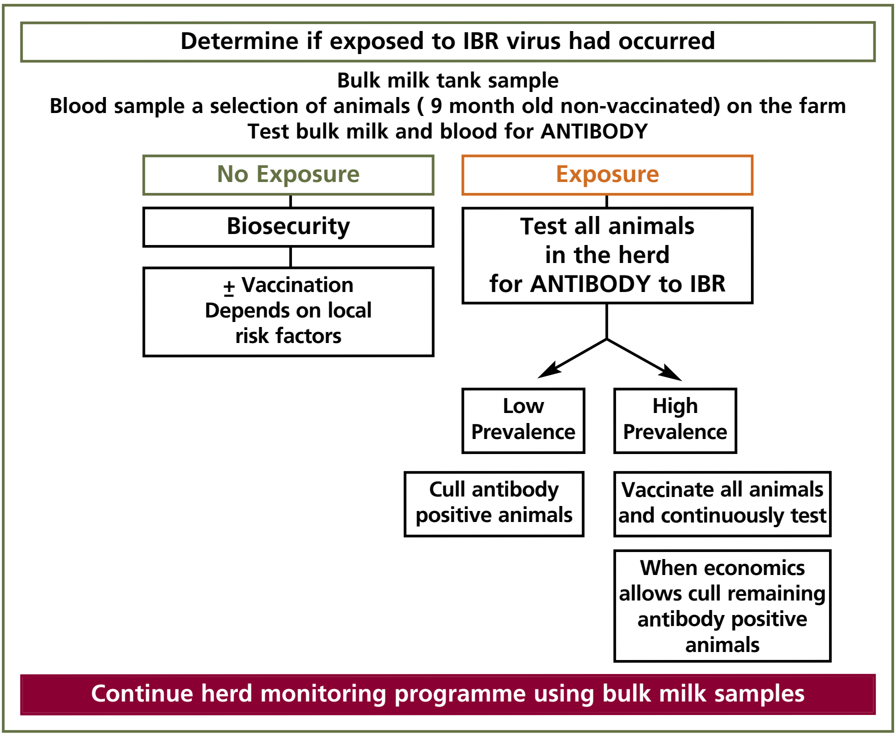
Biosecurity is the single most important contributor to the prevention of infectious diseases and subsequent losses on a farm. Biosecurity in its simplest form means the implementation of measures to prevent the introduction and spread of infectious diseases. It can be applied at a national level where measures are employed to prevent the introduction of a disease into a country. Prominent examples of this would be the measures employed to keep diseases such as foot and mouth and rabies out of Ireland. Biosecurity can also be applied at farm level, in order to prevent the introduction and spread of an infectious disease onto an individual farm. The higher the level of a particular disease in a country (prevalence of a disease), the stricter the biosecurity measures required to reduce the risk of disease introduction. With the already high prevalence of BVD in Ireland, and the increasing prevalence of IBR, biosecurity must now become an essential component of good farm management on Irish dairy farms.

Implementation of a strict closed herd policy is a critical component of biosecure disease control. A closed herd policy (i.e., no cattle movement onto the farm, including bulls) combined with on-farm biosecurity measures such as stock and disease-proof boundaries (three metre gap between neighbouring farms to prevent nose to nose contact), footbaths, restriction of visitors, disinfected veterinary equipment and single-use disposable needles, will optimise protection against the introduction of infectious diseases onto a farm. If feasible, a closed herd policy should be the primary biosecurity measure implemented. However, a recent Teagasc survey indicated that approximately 55% of dairy farmers intend expanding their dairy enterprises over the next five years, therefore a closed herd policy may be an unrealistic goal on many farms. In order to minimise viral disease risk when purchasing, therefore, the following biosecurity measures can be employed:

- Animals should be purchased from a single source if possible.
- Data on the health history of the source herd, the individual animals to be purchased and their vaccination status should be requested.
- All newly purchased animals including bulls should be quarantined correctly i.e., isolated for at least 30 days in an area that is at least three metres from other cattle groups, with no sharing of feed or water troughs and no mixing of dung and urine. Using an isolated paddock is an ideal solution to avoid problems with indoor quarantine. Animals from different source herds should be quarantined separately.
- On day 21 of the quarantine period, newly purchased animals should be tested for BVD virus and antibodies against IBR.

These procedures will reduce viral disease introduction and transmission in open herds.

Figure 4 : Monitoring and control of IBR in a dairy herd



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

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

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

Planned research at Moorepark

Disease control, biosecurity, and on-farm health planning such as herd health statements will prove crucial to achieving optimal efficiency on dairy farms in order to meet the increasing demands of dairy markets. Due to the impact of non-regulated infectious disease on Irish dairy farms and the necessity to actively promote on-farm health planning, Teagasc, Moorepark has initiated a new herd health research initiative – the 'Herd Ahead' programme. This project aims to address the lack of recent published disease prevalence data for BVD, IBR, leptospirosis and a range of addition infectious diseases, and to then use that data as a basis for designing a dairy herd health strategy. This project will identify the non-regulatory infectious diseases requiring prioritisation in Ireland based on prevalence and economic impact data. Economic impact studies are required in order to achieve stakeholder 'buy-in' to the concept of on-farm health planning and these will be carried out by examining disease seroprevalence and subsequently calculating inferred costs of disease across study farms. In terms of on-farm health planning, the project should result in an increased awareness and implementation of biosecurity, continuous disease monitoring, appropriate vaccination, and farm-specific health statements on Irish dairy farms. The baseline data generated in this study will act as a benchmark from which the impact of future herd health strategies and their contribution towards sustainable dairy farming can be measured.

Conclusion

Diseased animals perform sub-optimally and decrease on-farm profitability through waste feed, labour and veterinary costs. By using the combined approach of biosecurity, diagnostic testing and vaccination on individual farms, control of BVD and IBR, both on-farm and nationally, will become feasible, and will reduce the economic impact of these costly diseases. The following summary table outlines the basic steps of BVD and IBR control.

Eliminate BVD from your herd by	Eliminate IBR from your herd by
1. Testing for and removing persistently infected animals 2. Designing and implementing a biosecurity plan including diagnostic testing 3. Vaccinating	1. Vaccinating with a live vaccine in the face of an outbreak 2. Continuing to vaccinate at six-monthly intervals 3. Testing to establish the level of carriers n the herd 4. Culling carriers out of the herd when economically feasible 5. Designing and implementing a biosecurity plan including diagnostic testing