Research Day
Your levy, your future

DairyCo
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DairyCo Research and Development: Your levy, your future

Dear Attendee,

You are particularly welcome to SRUC, Crichton Royal Farm for the Research Day today, where we are showcasing some of the research being funded with the dairy levy.

Research and development is crucial to the dairy industry, to help us advance and become more competitive on a global level, to make dairy farming more efficient and increasingly sustainable.

Research is conducted by a number of different organisations, including commercial companies, as part of product development and academic institutions, funded, for example, by research councils such as BBSRC (Biotechnology and Biological Sciences Research Council).

DairyCo strives to fund unique, practical and applied research which can be applied on your farm. We actively seek to work collaboratively with other funders and sectors of the industry, including our partner divisions in AHDB, to ensure complementary effort and maximum return on your levy. We also have a close collaboration with dairy levy bodies in Europe (within a European Cattle Innovation Partnership), so we can avoid duplication and combine knowledge.

The DairyCo Board made a strategic decision to invest more in Research and Development, to provide the scientific evidence needed to underpin progress and raise the profile of GB dairy research. Since June 2011, we have had two five-year Research Partnerships in place – one on Health, Welfare and Nutrition and the second on Soils, Forage and Grassland. The Research Partnerships combine scientific expertise from ten leading scientific organisations and while they provide the backbone of our research effort, we have over 50 individual projects across a range of subjects. DairyCo supports more than 20 PhD students in dairy related topics, actively seeking to fund the next generation of scientists, advisors and technical experts to support the future of the dairy industry.

We can’t cover everything so we have to prioritise. Our strategy is shaped by a Research and Development Advisory Forum, made up predominately of practicing dairy farmers and independent industry experts. DairyCo staff here today, are very receptive to listening to your thoughts and comments on what information is required by the industry.

On show today we have a number of interesting and exciting projects for you. Researchers will be presenting their latest findings and will have key messages for you to take away; I would strongly encourage you to question the speakers. Also, please take the opportunity to find out what else DairyCo can provide to support you in your business. Within this booklet you will find more information on a selection of the research and DairyCo resources available to you.

I hope you have a very interesting and thought-provoking day.

Ray Keatinge
Head of Research and Development
What is Johne’s Disease?

- A chronic bacterial infection affecting the small intestine
- Disease takes years to develop: cattle are usually infected as calves but do not show clinical signs until adulthood, typically 3-5 years old
- Caused by Mycobacterium avium paratuberculosis and is often referred to as ParaTB, JD or Johne’s.

What does a cow with Johne’s look like?

- Cows look physically normal until the terminal stages of the disease but will be more likely to have mastitis, high somatic cell count (SCC), be lame or less fertile
- Clinical signs of Johne’s are scours and weight loss
- Regardless of how a Johne’s cow looks, it is a potential source of infection.

How do calves become infected?

- Calving yards contaminated with the bacteria
- Ingestion of the bacteria via faeces, colostrum or milk
- Udder and coat contamination of cows, calves ingest the bacteria while suckling.

Costs of Johne’s Disease

Estimated costs of Johne’s Disease are:

- **UK:** £13 million to beef and dairy cattle industry (Defra)
- **Ireland:** Reduces farm net profit by 15% (£7693) on a 100 cow herd (Teagasc)
- **US:** $200-250 million per year to US dairy herd (USDA).

Project aims

- Identify best practice preventive measures with a focus around calving
- Assess how these management practices impact on the health and productivity of dairy heifers
- Understand the extent to which implementing preventive measures reduces spread of Johne’s disease.

Industry involvement

- Six commercial farms throughout England and Wales are participating in the study
- Milk supplied to various milk-buyers and supermarkets
- NML and CIS are involved in Johne’s disease testing
- Initial results are being used by farm vets to improve health and welfare and to assist in development of Johne’s disease control programmes.

Research outline

**MAY 2012**

Most infections occur within the first two weeks of life.

Screen adult cows quarterly for Johne’s antibody using milk ELISA.

Collect data on calving management, eg cleanliness of dam and calving area, time taken for calf to stand, suckling behaviour, etc.

Take blood samples to assess colostral antibody transfer. Ongoing recording of heifer growth and health.

**MAY 2013**

Infected animals are unlikely to be +ve on agent or antibody testing. Use new diagnostic tests, eg gamma interferon.

Collect health and fertility data e.g. age at first observed oestrus and service, conception rate etc.

**MAY 2014**

Newly calved animals will enter the quarterly milk ELISA antibody testing programme to track when infected animals +ve.

Heifers will calve down for the first time.

Collect data on health (mastitis and lameness), production data (milk yield and SCC), fertility (time to first service, number of services).

**MAY 2015 Onwards**

knowledge transfer delivery of Johne’s Disease control plan.

This study forms part of DairyCo’s Research Partnership

For more information, visit www.dairyco.org.uk or contact Dr. Jenny Gibbons
Email: Jenny.Gibbons@dairyco.ahdb.org.uk Tel: 024 7647 8689
Introduction

BVD is an extremely expensive and time consuming disease to deal with on farm. Its effect on cattle means they may fail to reach peak performance, have lower immunity (so suffering more respiratory and infectious disease) and have poorer fertility. We cannot afford to ignore it.

So what can we do about BVD on farm?

There are four key steps to addressing BVD on farm.

- **STEP 1** Planning

  What am I investigating? How big is the problem? What is it I'm seeking to achieve?

  Do you know if BVD is a problem on your farm? Set a goal with your vet as part of your herds health plan, to know what your herd status is, decide what you would like it to be and know how you are going to get there.

- **STEP 2** Investigating

  What is my herd status and how do I identify individually infected animals?

  Knowing your herd’s status will give you the information to help select the most appropriate control to use on your farm. Bulk milk samples and/or youngstock blood samples help show whether BVD is a concern for your farm and whether you need to do more tests to fully understand where the problems lie.

- **STEP 3** Controlling

  What do I need to do to control BVD in my herd?

  When you know whether you have BVD or any PI animals on farm you can take steps to remove them, set up a vaccination strategy and ensure you have biosecurity controls in place.

- **STEP 4** Monitoring

  How do I know if my control programme is working?

  To make sure your control programme is working, regularly check the status of your herd.

How to get involved

To find out about future training events or find your nearest veterinary practice who are scheme providers, please contact the national BVD control programme at action@bvdcontrol.co.uk or on 01765 608489.

Join the national control programme to help manage BVD

Elizabeth Berry
DairyCo

We would like to thank Animal Health Ireland for the use of some of the materials.

This project is supported by the Rural Development Programme for England (RDPE) for which Defra is the Managing Authority, part funded by the European Agricultural Fund Development: Europe investing in rural areas.
Why is lameness important?

Some lame cows:
- Give less milk
- Take longer to get in calf
- More likely to be culled
- Are in pain and discomfort
- Cost your business money

Appearance of claw horn lesions

There are three main types of claw horn lesions seen in dairy cows:

- Sole Haemorrhage
- Sole Ulceration
- White Line Disease

Research on treatment of claw horn lesions

- Little scientific evidence exists to show how effective commonly used treatments for claw horn lesions are.

Clinical trial

- Twelve month study on five farms tested the effectiveness of foot blocks and pain killing medication on newly lame cows
- 500 cows identified through fortnightly mobility scoring as having newly gone lame
- 180 cows treated at random with one of the following treatment combinations:
  - Therapeutic treatment trim
  - Therapeutic treatment trim plus foot block on the sound claw
  - Therapeutic treatment trim plus three day course of anti-inflammatory (NSAID) pain killer
  - Therapeutic treatment trim plus foot block plus anti-inflammatory painkiller
- Three quarters of cows fitted with a foot block were better off than those receiving just a therapeutic trim
- Two thirds of cows given a NSAID were better off than those receiving just a therapeutic trim
- Five weeks after treatment 95% of cows treated with a therapeutic trim plus a foot block plus an anti-inflammatory pain killer were better off than receiving just a therapeutic trim.

Case study

- Reduction in the number of lame cows over a year following early and effective treatment
- Cows were mobility scored every two weeks
- Treated as soon as they became lame.

Early and effective treatment

- Cows recover more quickly
- Cows are less likely to go lame in the future
- Less impact on milk yield, fertility and profitability.

This study forms part of DairyCo’s Research Partnership
For more information, visit www.dairyco.org.uk or contact Dr. Jenny Gibbons
Email: Jenny.Gibbons@dairyco.ahdb.org.uk Tel: 024 7647 8689
Digital dermatitis (DD) is a skin infection found near the bulb of the heel and affects dairy cattle worldwide (Fig. 1). DD costs on average approximately £82 per case (1). Currently, no single effective treatment or preventative measure for DD exists.

**Cause of Digital Dermatitis**

- Bacteria called Treponemes are found in all DD lesions and are thought to be the cause of DD.

**What is Digital Dermatitis?**

- Digital dermatitis (DD) is a skin infection found near the bulb of the heel and affects dairy cattle worldwide (Fig. 1).

**What are Treponemes**

- Treponemes are typically found in the gut of cows (Fig. 2) and do not normally cause disease in the gut (2).
- Some Treponemes have the potential to feed on secretions from the mucous membrane of the gut which can be passed out in the cattle faeces (mucin casts).
- The DD Treponemes are the same family as those in the gut but are slightly different in type.
- Three different types of Treponeme that cause DD have been identified.

**Where do DD Treponemes reside?**

- It is not known exactly where in the cow’s body DD Treponemes reside. Previously, they have been found in gum tissue, rectal tissue and DD lesions.
- The project will test faecal samples, mucin casts, DD lesions, rectal and oral tissue in the lab for Treponemes (Fig. 3 and 4).

**Research questions**

- Where in the cow’s body do the DD Treponemes reside?
- Can DD Treponemes survive outside the cow in the farm environment (eg in slurry)?

**Where do DD Treponemes survive?**

- Treponemes do not survive in presence of oxygen but DD Treponemes may tolerate some level of oxygen.
- This project will test how well DD Treponemes survive under various conditions:
  - At different oxygen and pH levels
  - On or in different bedding materials
  - On healthy hoof tissue.
- This will identify if particular bedding materials are effective in killing or assisting survival of Treponemes.
- If Treponemes can live on healthy hoof tissue without causing disease, this will play an important role in understanding transmission of DD between cows.

**How to score DD lesions on your farm**

- A scoring system has been developed which allows identification of early lesions before they develop into acute lesions.
- Inspection of hind feet can be done in the parlour. DD lesions can be categorised into 6 different disease classes (Table 1).
- Easier to prevent an early stage DD lesion developing into an ulcerative lesion by footbathing than to try and treat an acute lesion.

![Fig. 1: A typical DD lesion](image1)

![Fig. 2: A Treponeme as seen under an electron microscope](image2)

![Fig. 3: Sieving faeces for mucin casts](image3)

![Fig. 4: A mucin cast](image4)

**Table 1: System for scoring digital dermatitis lesions**

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<th>Description</th>
<th>Picture</th>
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<tr>
<td>M0</td>
<td>Normal skin DD lesion absent</td>
<td>None or Minimal lameness</td>
</tr>
<tr>
<td>M1</td>
<td>Early stage lesion (approx. 0.2cm diameter) generally not painful</td>
<td>Lameness evident</td>
</tr>
<tr>
<td>M2</td>
<td>Acute lesion (over 2cm diameter) painful when palpated</td>
<td>Lameness evident</td>
</tr>
<tr>
<td>M3</td>
<td>Healing stage lesion covered by scab</td>
<td>Lameness evident</td>
</tr>
<tr>
<td>M4</td>
<td>Chronic lesion proliferation of skin, generally not painful</td>
<td>Can flare up and return to M2</td>
</tr>
<tr>
<td>M4.1</td>
<td>Acute on chronic chronic lesion with small area of acute lesion (&lt;25-50% of area)</td>
<td>Can flare up and return to M2</td>
</tr>
</tbody>
</table>

**References:**

2. Evans et al., 2008 Vet Microbiol 130: 141-150
3. Döpfer et al., 1997 Vet Record 140: 620-623

For more information, visit [www.dairyco.org.uk](http://www.dairyco.org.uk) or contact Dr. Jenny Gibbons, Email: Jenny.Gibbons@dairyco.ahdb.org.uk, Tel: 024 7647 8689
Introduction

- Lameness is a complex and multifactorial problem which requires a strategic approach
- The balanced scorecard is a widely used business and management tool to assist strategy
- Typical balanced scorecards used by business include measurements of performance in four key perspectives (Figure 1).

Materials and methods

- The balanced scorecard approach was adopted to create The DairyCo Healthy Feet Programme (DHFP)
- The DHFP is a strategic plan for lameness reduction on an individual herd level
- The DHFP is delivered by trained mobility mentors who are vets or category 1/licensed foot trimmer
- The ‘four success factors for healthy hooves’ proposed by Hulsen are widely used in the DHFP
  - Low Infection pressure
  - Good hoof shape and horn quality
  - Low forces on feet (short standing times; good cow flow; appropriate floor surfaces)
  - Early detection followed by prompt, effective treatment of lame cows
- The relative incidence of the three most commonly identified lesions causing lameness are used to help identify priority success factors

Results and discussion

- The balanced scorecard is likely to benefit the strategic approach to lameness reduction by helping to simplify a complex problem and to prioritise resources
- The DHFP was launched in 2011 across the UK and, since its launch, 100 mobility mentors have been trained and 52,000 cows on 220 UK farms have been enrolled on the DHFP
- Data from the DHFP will be used to evaluate the impact of this approach on lameness reduction on commercial farms
- Feedback from farmers on DHFP suggests this approach is popular and easily understandable by the entire farm team
- The balanced scorecard approach is reviewed and refined on an annual basis
- This approach could be adopted for other endemic diseases and in other livestock sectors.
The DairyCo Healthy Feet Programme (DHFP) works with producers to:

- Reduce the number of lame cows on farm
- Improve management of cows
- Improve staff morale.

Lameness can be caused by infection, physical and management factors.

Effective lameness control involves understanding which types of lameness are present and taking a structured approach to tackle the underlying causes.

**Introduction**

- Provides a framework to measure lameness, monitor progress and motivate all staff
- Uses trained Mobility Mentors who facilitate and guide the process
- Brings the farm team together in a structured way to implement the necessary changes
- Increases skills and knowledge so the whole farm team knows what to do to reduce lameness.

**The programme**

- The DHFP is a monitoring and control strategy that will look at basic steps:
  - Diagnosis – what is the problem and how big is it?
  - Risk assessment – what is causing the problem?
  - Action plan – what can be done about it?
  - Skill development – what are the necessary skills for long-term lameness control?
  - Monitoring – is progress being made?

- Trained providers known as ‘Mobility Mentors’ (vets or licensed foot trimmers) act as one-to-one advisers and facilitate the whole process
- Resources are provided to ensure that the correct and relevant information is always available
- The focus of DHFP is to improve producer confidence to make necessary required management changes on farm
- DHFP will evolve to take account of findings from DairyCo funded research as well as other peer reviewed studies.

**Delivery model**

- Farm enrols
  - First two visits of programme
  - First independent herd mobility score
  - Agree Mobility Contract (third visit)
  - Implementation and monitor
  - Review
  - Independent herd mobility scoring every three months
  - Weeks 1-3
  - Weeks 4-25
  - Week 25

**How to get involved**

- Mobility mentors are based throughout the country
- They work with clients to understand and tackle the factors around lameness and promote the four success factors
- Resources linked to the messages and actions are available for use on farm
- Contact your vet or local Extension Officer.

**Success factors**

DHFP prevents lameness by focusing on four success factors:

- Low infection pressure
- Good horn quality and hoof shape
- Low forces on the feet – good cow comfort and cow flow
- Early detection and prompt, effective treatment of lame cows.

**DairyCo resources**

Resources are available to help achieve the ‘four success factors’.

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The DairyCo Healthy Feet Programme is one of DairyCo’s products and services. For more information, visit dairyco.org.uk/healthyfeet or contact Kate Cross at healthyfeet@dairyco.ahdb.org.uk Tel: 024 7647 8686
Control and prevention of mastitis in dairy herds

Pete Down, James Breen and Martin Green
University of Nottingham, School of Veterinary Medicine & Science

Introduction

- Mastitis control is traditionally based on generic farm plans, eg 5-point plan
- The aim of such plans is to implement a small number of management items that are usually related to the control of persistent ‘contagious’ pathogens
- The assumption that infection is spreading between infected cows ignores the fact that the environment is often more important in UK dairy farms
- Research, funded by DairyCo, has found that individual farm control plans, designed around the specific disease pattern on that farm, can be very effective at reducing mastitis
- This approach has since been made available to all UK dairy farms as the DairyCo Mastitis Control Plan (DMCP), the main aspects are highlighted on this poster.

Identifying the source of infection

- Identifying the main source of new infections with respect to pathogen type, eg environmental or contagious and whether most infections are acquired during the dry period or during lactation, relies on the interpretation of somatic cell count records and clinical mastitis records (Figure 1)
- A ‘diagnosis’ is assigned, based on the source of new infections:
  - Environmental Dry Period (EDP)
  - Environmental Lactating Period (ELP)
  - Contagious Dry Period (CDP)
  - Contagious Lactating Period (CLP)
- The herd ‘diagnosis’ is used to identify management and husbandry changes that are most likely to result in significant benefits.

Control measures

- The DMCP involves a comprehensive questionnaire that covers all aspects of management relevant to mastitis
- Key areas are identified from the questionnaire according to the ‘diagnosis’ made
- This approach avoids wasting time and money on measures that are unlikely to benefit a particular farm
- Control of mastitis may focus on some of the areas described below

<table>
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<td>Pasture management</td>
<td>Teat hygiene and pre-milking teat disinfection</td>
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<td>Selection and use of Dry Cow Therapy</td>
<td>Pasture rotation</td>
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<tr>
<td>Infusion technique at drying-off</td>
<td>Slurry management</td>
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<tr>
<td>Management of calving cows</td>
<td>Teat end condition</td>
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Contagious

- Prompt identification of clinical mastitis
- Post-milking teat disinfection
- Cow segregation
- Parlour maintenance
- Biosecurity

Summary

- There is no ‘one size fits all’ approach to effective mastitis control
- Somatic cell count and clinical mastitis data must be used to identify the source of new infections
- This approach, as used by the DairyCo Mastitis Control Plan, has been proven to be effective and is currently available to all UK dairy farmers.

For more information, visit www.dairyco.org.uk or contact Dr. Jenny Gibbons
Email: Jenny.Gibbons@dairyco.ahdb.org.uk; Tel: 024 7647 8689

LMI = Lactational intra-mammary infection
MAR = Maximum advisable rate.

Fig1: Clinical mastitis data with a dry period origin infection pattern (top). Somatic cell count data showing an increased rate of new intramammary infections in the summer months denoting an environmental infection pattern (below) (Total Vet, QMMS/SUM-IT)
The initial five point plan, developed in the 1960s, was aimed at the control of contagious mastitis.

Initial research for the DairyCo Mastitis Control Plan started in 2004, trialled on 26 herds with another 26 as controls.

After one year of implementing the Plan farms saw a 22% decrease in clinical mastitis rates compared to control herds.

The DairyCo Mastitis Control Plan, focusses on reducing mastitis cases and somatic cell counts on farm.

The Plan minimises the need for antibiotic treatment.

Benefits

- The DairyCo Mastitis Control Plan is a proven, structured, evidence based and wide ranging approach to mastitis prevention and control in dairy cattle.
- Farms that have implemented the plan and have shown compliance to the recommendations have seen greater reductions in clinical mastitis and somatic cell count rates.

How to get involved

- Plan deliverers are based throughout the country
- Plan deliverer contact details are available on the DairyCo website.
- The cost of DMCP is dictated by your Plan deliverer.
- DairyCo resources are available for both plan promotion and to support on farm best practice.
- Contact your local Extension Officer.

The DairyCo Mastitis Control Plan is one of DairyCo’s products and services.

For more information, visit www.dairyco.org.uk/mastitis

Email: mastitiscontrol@dairyco.ahdb.org.uk, Tel: 024 7647 8878
Mineral requirements of dairy cows

Mineral requirements of dairy cows

Liam Sinclair
Harper Adams University

Background

• Minerals are a key component affecting cow performance, health, fertility and welfare
• Some minerals are required in g/kg and some mg/kg. The amount needed does not reflect their importance to the cow
• Minerals interact with each other, making correct feeding levels more complex.

Mineral survey

• Mineral levels fed on 50 farms in the Midlands and North of England were investigated (Figure 2)
• Samples of TMR, concentrate, forage and water minerals were analysed for the high and low-yielding groups
• Contributions from additional sources (eg bolus, free access minerals) were calculated.

Results

• The majority of farms used supplementary minerals in addition to that in the concentrates or TMR (Graph 1)
• On average, all minerals were being fed in excess of requirements, with some (eg copper) being fed in amounts that could compromise animal health (Graph 2)
• Feeding excess will increase diet costs and could have a negative effect on the environment (eg phosphorus).

Graph 1: Supplementary sources of minerals in addition to that in the concentrates or TMR on 50 dairy farms

Graph 2: Mean intake of some major and trace minerals on 50 dairy farms, expressed as a percentage of NRC (2001) requirements

Copper

• Under normal conditions copper in the total ration should be formulated to a maximum of 20mg/kg DM
• 31 farms were feeding above 20mg/kg DM and four above the maximum permitted level of 40mg/kg DM
• Copper deficiency is also one of the most common mineral issues seen at Vet Investigation Centres
• Most of the copper deficiency problems in the UK are due to the effects of antagonists such as molybdenum, sulphur and iron
• Some farms in this study had high molybdenum levels but these were not the same ones that were feeding high levels of copper

Managing mineral supplementation

• Farmers, nutritional advisers and vets should all be involved in mineral nutrition but one person should have overall responsibility
• All sources of mineral supply (eg water, bolus, free access) should be taken into account
• Assessing mineral requirements on a farm should start with forage analysis
• Forage analysis is more useful than blood tests when looking at copper levels
• Biopsies of cull cow livers can also help to identify if there is excess copper in the diet.

This study forms part of DairyCo’s Research Partnership
For more information, visit www.dairyco.org.uk or contact Dr. Jenny Gibbons
Email: Jenny.Gibbons@dairyco.ahdb.org.uk Tel: 024 7647 8689
Introduction

• Feeding is the largest dairy herd cost and it offers the greatest potential for improving profitability (Fig. 1).
• Meeting the nutritional needs of cows as completely and cost-effectively as possible is the primary purpose of dairy feeding.
• Feeding+ is a DairyCo resource designed to help producers improve business performance and profitability with the best possible herd nutrition.

Features

• Feeding+ is a structured reference to all critical elements of herd nutrition and feeding.
• The manual can either be used alongside a training programme or as a stand-alone resource.
• The manual contains ten separate but inter-linked sections:
  1. Improving through feeding
  2. Planning your nutrition
  3. Planning your feeding
  4. Assessing your feed options
  5. Managing your forage feeds
  6. Managing your non-forage feeds
  7. Managing your feeding
  8. Managing organic feeding
  9. Managing dry cow feeding
 10. Managing youngstock feeding.
• The sections are cross linked to information contained in other DairyCo improvement programmes including:

Feeding+ has been designed and written by four highly respected nutrition specialists. This builds on research carried out by the DairyCo economics team which analyse the costs that goes into producing a litre of milk in the UK. This research showed a marked difference in feeding costs between the most and least efficient producers and highlights that many dairy farmers could make significant savings.

The Feeding+ programme promotes feed efficiency for yield, quality and profit.

Benefits

• The information in Feeding+ will help you to:
  • Assess the current feeding efficiency
  • Plan potential improvements in feeding efficiency
  • Plan the most cost-effective milk production
  • Make the most of the feeding options and opportunities available
  • Make the most of forage feeding
  • Make the most of non-forage feeding
  • Plan diets to fulfil animal requirements
  • Make the most of organic feeding
  • Prepare cows as well as possible for the next lactation
  • Calve heifers successfully and economically at two years of age.

Fig 1: Comparison of costs (%) of enterprise type

Source: Milkbench+

How to get involved

• Order DairyCo Feeding+:
  • Visit the DairyCo website www.dairyco.org.uk
  • Call 024 7669 2051
  • Email info@dairyco.ahdb.org.uk
Why out-winter heifers?

The trend towards expanding herd size creates extra accommodation requirements for youngstock. Options for expanding include:

- Constructing extra buildings (*high capital*)
- Purchasing in-milk heifers (*biosecurity*)
- Woodchip pads
- Out-wintering replacement heifers.

Little is known about the current practices of out-wintering or the performance of these animals during the rearing period in comparison with housed heifers.

Site selection:
Choosing free-draining, dry soils was the primary criteria for selecting a suitable area to out-winter heifers. Field selection and soil type was also key to:

- Avoiding poaching
- Avoiding run-off
- Providing dry lying areas.

Animal performance:
Over the out-wintering period farmers estimated:

- LWG of 0.54 kg per day
- 96% of heifers gained (59%) or maintained (37%) body condition score.

Year 1 – Survey of current practice

Seventy farmers participated in a survey in 2012. Participants each had an average of 9.7 years experience out-wintering heifers.

The top 4 reasons for out-wintering heifers were:
1. To reduce the cost of heifer rearing
2. To improve animal health and welfare
3. To reduce labour input
4. To alleviate pressure on buildings.

The most popular forages for out-wintering heifers were:

1. Grass (55% of farms)
2. Kale (36% of farms)
3. Fodder beet (32% of farms)

Out-wintered heifer performance in winter and first lactation, soil condition and effect of a mineral bolus is being measured on low input, spring calving, cross bred dairy herds in 2013:

- 9 farms – 3 grass, 3 kale, 3 fodder beet
- 360 heifers – 40 on each farm
- Half of the heifers were given a mineral bolus

Measurements include: forage quality and utilisation, LWG, milk yields, health and fertility.

Year 3 – Out-wintering for high input farms

The performance of housed heifers will be compared with heifers outwintered on kale, fodder beet and deferred grazing in 2014-2015:

- Holstein-Friesian Heifers
- Milk production system – high input 9000L+.

Outcomes

- Determine performance, current and best practice in dairy herds that out-winter
- Evaluate the suitability of out-wintering heifer systems for low and high input dairy herds.

This study forms part of DairyCo’s Research Partnership
For more information, visit [www.dairyco.org.uk](http://www.dairyco.org.uk) or contact Dr. Debbie McConnell
Email: [Debbie.McConnell@dairyco.ahdb.org.uk](mailto:Debbie.McConnell@dairyco.ahdb.org.uk); Tel: 024 7647 8704
Growing and feeding lucerne silage for dairy cows
Barney Jones, Tom Burns-Price, David Humphries and Chris Reynolds.
University of Reading

**Background**

- Lucerne is the most cultivated forage legume in the world, especially in the USA, Canada, Argentina, South Africa, Australia and Southern Europe
- Limited area grown in the UK despite proven high yields, protein content and digestibility and no nitrogen requirement. It’s estimated that as much as 1,000,000 acres of UK land would be suitable for lucerne
- Lucerne is a nitrogen fixing legume with similar properties to red clover and the potential to provide an economic source of home grown protein
- A deep tap root makes lucerne suitable for dry conditions
- Optimising management should see crop persistency of 4-6 years producing up to 15 tonnes DM/Ha at 18-25% crude protein.

**Summary of work**

- To determine the effect of feeding lucerne silage in UK dairy cow rations on performance, milk composition, rumen health, N efficiency and economics
- To determine the effect of chop length on digestibility of lucerne and maize diets
- Examine the influence of harvesting date on crop yield and the subsequent performance of dairy cows.

**Forage production – trial plots**

- Daisy (20kg/Ha) sown either in September or following last frost in the spring with and without a cover crop of spring barley at 50% rate
- Plots will be used to determine effects on dry matter yield and chemical composition. Effect of harvest date will also be analysed and the results of these trials will provide a basis for future recommendations.

**Forage production – Field scale**

- Lucerne established in 2012 at 3 partner sites (Reading, Harper Adams, SRUC)
- Reading will focus on effects of timing of harvest on forage quality. Lucerne will be harvested at either bud or bloom stage for both first and second cuts. The lucerne will have a 24h wilt and will be baled and wrapped with an inoculant additive.

**Feeding trials at Reading**

- Feeding trials will be conducted to determine the effects of harvest timing on production performance in an applied study with high yielding dairy cows fed a TMR
- A second trial will determine the effect of chop length and level of TMR inclusion on rumen function.

<table>
<thead>
<tr>
<th>Harvest date trial</th>
<th>Chop length trial</th>
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<tbody>
<tr>
<td>20 multiparous dairy cows</td>
<td>4 mid lactation dairy cows at approximately 12 weeks postpartum</td>
</tr>
<tr>
<td>4 x 4 latin square</td>
<td>4 x 4 latin square</td>
</tr>
</tbody>
</table>

4 dietary treatments:
- 1st cut lucerne; bud stage
- 1st cut lucerne; full bloom
- 2nd cut lucerne; bud stage
- 2nd cut lucerne; full bloom

4 treatments:
- 25% lucerne; short chop length
- 25% lucerne; long chop length
- 75% lucerne; short chop length
- 75% lucerne, long chop length

Diet fed as a total mixed ration with 50% forage (50:50 lucerne:maize silage) and approximately 16% CP. Diet a total mixed ration with 50% forage based on lucerne and maize silage in ratios of 25:75 or 75:25.

**This study forms part of DairyCo’s Research Partnership**

For more information, visit [www.dairyco.org.uk](http://www.dairyco.org.uk) or contact Dr. Debbie McConnell

Email: [Debbie.McConnell@dairyco.ahdb.org.uk](mailto:Debbie.McConnell@dairyco.ahdb.org.uk); Tel: 024 7647 8704
Estimated 70% of grassland soils in England and Wales exhibit severe or moderate soil compaction. Soil compaction restricts plant root growth and penetration and reduces water movement through the soil. Compaction alters soil microbial activity which can increase emissions of nitrous oxide ($\text{N}_2\text{O}$) (a greenhouse gas) and reduce the amount of nutrients available to the grass sward.

**Project aims**

- To assess the impact of soil compaction by animals and machinery on grass yield
- To investigate nutrient use efficiencies on compacted soils.

**Experiment**

Three treatments:
- No compaction
- Tractor compaction
- Trampling compaction

The treatments were imposed in October 2011. Sub-treatments of surface and sub-soil aeration have been imposed on each main treatment. Two gas chambers are used to monitor $\text{N}_2\text{O}$ on each sub-plot. Three cuts of grass silage were taken in 2012.

**Results**

**Soil structure**

- Trampling compaction
- Tractor compaction
- No compaction

**Total grass yield**

The mean dry matter yields from the 1st cut taken in May 2012 showed that the compaction treatments had reduced yield. The trampled and tractor compacted plots yielded 19.1% and 13.5% less respectively than plots with no compaction (see Graph 1).

**Nitrous oxide emissions**

For the first fertiliser application in the spring the greatest emissions of $\text{N}_2\text{O}$ were from the tractor compacted plots > trampled plots > the control plots.

The tractor compacted plots had an increase of 14.9g $\text{N}_2\text{O}$/ha/day and the trampled plots 7.4g/ha/day compared with the control plots.

**Summary**

- Compaction reduces yield in the 1st cut of grass
- Trampling compaction reduces yield more than tractor compaction
- Tractor compaction gives rise to greater $\text{N}_2\text{O}$ emissions than trampling compaction post the spring fertiliser application
- Spring fertiliser application gives rise to greater $\text{N}_2\text{O}$ emissions following tractor compaction.

This study forms part of DairyCo’s Research Partnership

For more information, visit www.dairyco.org.uk or contact Dr. Debbie McConnell

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Growing grass with nutrients from separated slurry

Chris Henry and Dave Roberts
SRUC

Slurry separation

Mechanical separation of slurry involves the partitioning of slurry into a stackable fibrous fraction and a liquid fraction. There are a number of advantages and disadvantages to slurry separation:

- Reduction in slurry volume (see Table 1)
- Easier handling of liquid
- Lower dry matter content = lower sward contamination and greater window for slurry application
- Option to export the solid fraction (reduce nutrient loading)
- No closed period for solid application
- Higher available nitrogen in separated liquid fraction (see Table 2).

- High capital cost of equipment ≈ £25 000
- Infrastructure requirements – reception and storage tanks, solid store
- Maintenance costs.

<table>
<thead>
<tr>
<th>Slurry dry matter (%)</th>
<th>Volume reduction* (%)</th>
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</thead>
<tbody>
<tr>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>6</td>
<td>13</td>
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<td>7</td>
<td>17</td>
</tr>
<tr>
<td>8</td>
<td>21</td>
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</tbody>
</table>

* Figures from CAFRE Technical Note: Mechanical Separation of slurry on N.I. dairy farms

Table 1: Reduction in the volume of cattle slurry by brushed screen separation at varying slurry dry matter (DM) contents

Using separated slurry on grasslands

- As fertiliser prices increase, slurry is an increasingly important source of nutrients on farm
- Higher ammonium-N and lower DM content of the liquid fraction may encourage better grass growth
- Little information is available on the performance of swards grown from separated slurry
- Two experiments to evaluate:
  1. Grass silage grown using separated slurry
  2. Use of separated slurry on grazing pastures.

Study 1. Separated slurry for grass silage

Question: How will the performance of grass swards grown using nutrients from separated slurry compare with those grown from other nutrient sources?

Over a two year period grass growth from a 3-cut silage system will be monitored under 5 key treatments:

Treatments:
- Three nutrient sources:
  - Fertiliser
  - Whole slurry
  - Separated slurry.
- Two slurry application methods:
  - Shallow injection
  - Drible bar.

Study 2. Separated slurry on grazing pastures

Question: Can separated slurry be used effectively in dairy grazing pastures to supply nutrients for grass growth and support the performance of mid-late lactation dairy cows?

Treatments:
- Fertiliser
- Whole slurry
- Separated slurry

Measurements:
- Animal performance – milk yield and LWG
- Grazing behaviour
- Grass growth and quality.

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Using nitrate soil sensors to increase sustainability

Rory Shaw¹, Davey Jones¹, Prysor Williams¹ and Tony Miller²
¹School of Environment, Natural Resources and Geography, University of Bangor; ²John Innes Centre, Norwich

The nitrogen problem

- A large proportion of nitrogen (N) in fertilisers and manures is lost to the environment during and following application. This represents an economic loss to the farmer
- Loss of nitrogen to groundwater as nitrate constitutes a significant pollution risk
- Emissions of gaseous nitrogen from soil is increased by fertiliser additions and contributes to global warming
- Farms within Nitrate Vulnerable Zones (NVZs) face restrictions on fertiliser and manure use
- The aim of this study is to investigate how real time in-situ nitrate sensors may improve the efficiency of nitrogen inputs.

Nitrate sensors

- The sensor consists of an electrode which is attached to a data logger
- The electrode can be placed into soil or water and the nitrate concentration recorded continuously over a period of time
- The sensor may be coupled with a wireless device to allow remote monitoring
- The nitrate electrode is an ion selective electrode and works just like a pH probe
- The electrode gives an output in volts, which is related to the concentration of nitrate in the soil solution. Calibration of the electrodes before use allows the voltage output to be converted into nitrate concentration.

Nitrate – a dynamically important molecule

- Nitrate is the most important source of N for crop plants
- Nitrate concentration in the soil is very dynamic and changes quickly in response to fertiliser and manure inputs, changes in the weather and crop uptake
- Current methods of testing soil nitrate concentrations are costly, time consuming and involve a delay from sampling to when the results become available
- This makes accurate calculation of fertiliser requirements more difficult.

Using the sensors to improve nitrogen use

- Continuous monitoring of soil nitrate concentration may allow more accurate application of nitrogen fertiliser
- The sensors will improve our knowledge of nitrate dynamics in a range of agricultural systems and fertiliser regimes
- This may allow improvements to be made to fertiliser recommendations and models used by farmers
- We plan to investigate the effect that different clover densities has on the nitrate dynamics of the soil.
- Prototypes are currently being tested and characterised in the lab with the hope that field trials will start in the spring/summer

For more information, visit www.dairyco.org.uk or contact Dr. Debbie McConnell
Email: debbie.mcconnell@dairyco.ahdb.org.uk Tel: 024 7647 8704
Grass+ is designed in separate sections, each focusing on a different aspect of pasture, grazing and harvesting management.

Grass represents the highest volume and the cheapest form of feed in the dairy ration – how it is used and managed varies greatly according to the farm system.

- Making more from your grass
- Calculating the cost of your feeds
- Assessing your pasture
- Planning your grazing
- Managing your grazing
- Supplementing grazing
- Shortening your winter feeding
- Planning your silage-making
- Maximising sward productivity

Grass+ has been designed and written by a panel of leading British grassland management advisors and practitioners. This builds on research carried out by the DairyCo economics team which analyse costs that go into producing a litre of milk in the UK.

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- Optimising fertiliser practice
- Renewing swards
- Managing organic swards
- Grazing high-yielding cows

Grass+ also contains:

- Factsheets which provide more detailed information and guidance on subjects and techniques discussed in the main sections
- Worksheets are provided to help you implement changes on your farm.

The sections are cross linked to information contained in other DairyCo improvement programmes including:

Forage for knowledge

Forage for Knowledge is the DairyCo grass analysis project for 2013. We are following 10 farmers across GB as they aim to maintain grass quality and maximise grass yield throughout the season. Regular measurements of Grass growth, and analysis of dry matter, metabolisable energy and crude protein are published. The newsletter also contains the most up to date forage related news and research from around the globe with links to the latest grassland measurements, topical technical hints to help get the best from your grass and other forages.

How to get involved

Order DairyCo Grass+:
- Visit the DairyCo website [www.dairyco.org.uk](http://www.dairyco.org.uk)
- Call 024 7669 2051
- Email info@dairyco.ahdb.org.uk

Sign up to the forage for knowledge e-newsletter which is distributed fortnightly across the grazing season. [www.dairyco.org.uk/sign-up-to-emails](http://www.dairyco.org.uk/sign-up-to-emails)
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DairyCo is a division of the Agriculture and Horticulture Development Board