Mastitis in dairy cows:
Research to national control scheme

Martin Green
School of Veterinary Medicine and Science
What is mastitis?
Mastitis...

Inflammation of the mammary gland...

...any disease which causes an immune response and inflammation of mammary tissue
Causes of mastitis

All can cause “mastitis”

**Bacteria**

- Viruses
- Fungi
- Physical e.g. trauma
- Toxins
- Neoplasia
Clinical Signs

Changes to the milk

Inflammation of the gland
- Swollen
- Hot
- Hard
- Painful
- Pos necrosis of the quarter
Clinical Signs

Sometimes very sick...

- Reduced yield
- Temperature drop
- Vascular collapse
- Death
Why is mastitis important?

- Common (worldwide)...
- Serious repercussions...
• Clinical mastitis

• Subclinical mastitis

>50 cases/100 cows/yr

~25% cows infected at any one time
• **Cost**
  - 40% direct costs of common diseases
  - £200M UK (US$2.0B)

• **Public health**
  - Bacteria in milk
  - Antibiotic use

• **Welfare**
  - Farm animal welfare council

• **Sustainability**
  - Wastage, costs, environmental impact...
My Journey

Low bulk milk SCC and toxic mastitis.
Green M, Green L, Cripps P.

Comparison of fluid and flunixin meglumine therapy in combination and individually in the treatment of toxic mastitis.
Green MJ, Green LE, Cripps PJ.
Orchard Veterinary Group, Glastonbury, Somerset.
Control of mastitis

Prevent infections

Reduce pathogen transmission

Between cows (milking)

Environment to cow

Management intervention

Vaccines may come but do...
Initial studies on control...coincidence

- Environmental causes serious problem


**Environmental pathogens and intramammary infection during the dry period.**

*Smith KL, Todhunter DA, Schoenberger PS.*
Dry period

2 Months

10 Months
Simple dry period study

End 1990s in 6 Somerset dairy herds...
## New Infections during the Dry Period

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Quarters acquiring an infection during the dry period (no.)</th>
<th>Quarters acquiring an infection during the dry period (%)</th>
<th>New infections as a proportion of infections detected in the dry period (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Escherichia coli</strong></td>
<td>1197</td>
<td>101</td>
<td>8.6</td>
<td>97.0</td>
</tr>
<tr>
<td>All Enterobacteriaceae</td>
<td>1197</td>
<td>149</td>
<td>12.8</td>
<td>96.6</td>
</tr>
</tbody>
</table>

*Journal of Dairy Science*

**A Study of the Incidence and Significance of Intramammary Enterobacterial Infections Acquired During the Dry Period**

A.J. Bradley†, M.J. Green†
Do these dry period infections cause mastitis?
Strains of E coli
DNA Fingerprinting - Cow 312 B (RH)

E coli.

Isolates: 2 weeks pre-calving
Calving
Mastitis: Week 8
Week 9
Week 10
DNA Fingerprinting - Cow 744 B (RH)

E. coli

Isolates:
- 4 weeks pre-calving
- 2 weeks pre-calving
- 1 weeks pre-calving

Mastitis:
- Week 1
- Week 7
- Week 10
DNA Fingerprinting - Cow 167 S (LH)

E. coli

Isolates: 2 weeks pre-calving

1 weeks pre-calving

Mastitis: Week 2
Changing behaviour of environmental bacteria

It turned out to be important...

...in some herds...

>50% cows became newly infected during Dry Period

>75% of all mastitis originated in the Dry Period
Mastitis in the first 30 days of Lactation

Incidence Rate of Clinical Mastitis (Cases per Cow at Risk)

Farm-years in Ascending order of Clinical Mastitis Incidence
Research into Industry
...Prevention?

Preventive Treatments

Pathogen, Cow, Farm, Management
Dry Cow Treatment: A Clinical Trial

- Target therapy towards a specific types of bacteria
  - Gram negative
- RCT - using a targeted product
  - Found a 50% reduction in clinical gram negative mastitis
- Confirmed that preventing DP infections does reduce mastitis after calving

Non-Antibiotic Approaches

- Teat sealant during the dry period
  - Jon Huxley PhD
- Efficacy was at least as good as a long acting antibiotic

65% bismuth sub nitrate in a paraffin base

Follow on research

Preventive Treatments

Pathogen, Cow, Farm, Management
Determinants of Mastitis arising from the Dry Period

- Cow
- Bacterial Interactions
- Environment
- Management

Dry Period Decisions
Further studies

**Prevalence and associations between bacterial isolates from dry mammary glands of dairy cows.**

Green MJ, Green LE, Bradley AJ, Burton PR, Schukken YH, Medley GF.

Ecology and Epidemiology Group, Department of Biological Sciences, University of Warwick, Coventry.

**Influence of dry period bacterial intramammary infection on clinical mastitis in dairy cows.**

Green MJ, Green LE, Medley GF, Schukken YH, Bradley AJ.

Department of Biological Sciences, University of Warwick, Coventry, UK. martin@greenl.swinternet.co.uk

**Making Good Decisions on Dry Cow Management to Improve Udder Health - Synthesising Evidence in a Bayesian Framework.**


School of Mathematical Science, University of Nottingham, Sutton Bonington Campus, Sutton Bonington, LE12 5RD.

**Cow, farm, and herd management factors in the dry period associated with raised somatic cell counts in early lactation.**

Green MJ, Bradley AJ, Medley GF, Browne WJ.

School of Veterinary Medicine and Science, University of Nottingham, Sutton Bonington Campus, Sutton Bonington, LE12 5RD. martin.green@nottingham.ac.uk

**Cow, farm, and management factors during the dry period that determine the rate of clinical mastitis after calving.**

Green MJ, Bradley AJ, Medley GF, Browne WJ.

School of Veterinary Medicine and Science, University of Nottingham, Sutton Bonington, LE12 5RD, United Kingdom. martin.green@nottingham.ac.uk
Bacterial communities...

Prevalence and associations between bacterial isolates from dry mammary glands of dairy cows.
Green MJ, Green LE, Bradley AJ, Burton PR, Schuttenk YH, Medley GF.
Ecology and Epidemiology Group, Department of Biological Sciences, University of Warwick, Coventry.

Characterization of the diversity and temporal stability of bacterial communities in human milk.
Department of Animal and Veterinary Science, University of Idaho, Moscow, Idaho, United States of America.

The human milk microbiome changes over lactation and is shaped by maternal weight and mode of delivery.
Cabrera-Rubio R, Collado MC, Lahtinen K, Salmiainen S, Isolauri E, Mira A.
Joint Unit of Research in Genomics and Health, Centre for Public Health Research and the Institute of Biomedicine, University of Turku, Turku, Finland.
Cow and management factors

- Previous Lactation
- Drying Off
- Early Dry period
- Late Dry Period
- Calving Period
- Overall herd factors

Some ‘simple but effective’...
Drying Off

Surgical spirit swab before administer dry treatments ↓ risk
Late Dry Period

Transition yard area > 1.25m² per 1000kg annual mean cow milk production ↓ risk

8000kg ~ 10m²
Late Dry Period

Pasture grazing policy is:
Graze for 2 weeks then rest 4 weeks
↓ risk
Farm tool for dry period management

Reducing mastitis during the dry period: A cost-effectiveness tool

Please enter the number of cows in your herd that apply for each of the following:

Approximate number of cows dried off each year:
- 100 cows

Approximate percentage of cows getting a FIRST case of mastitis in the first 30 DIM:
- 20

Approximate percentage of cows that spend their dry period at pasture:
- 50

Enter the percentage of cows in the herd falling into the categories in the gray table (so the values add up to 100%)

<table>
<thead>
<tr>
<th>SCC in the first milk recording after calving</th>
<th>&lt; 200,000 cells/mL</th>
<th>&gt; 200,000 cells/mL</th>
</tr>
</thead>
<tbody>
<tr>
<td>48</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

Overall net cost-benefit (£ saved in year one after costs)

European dry period infections
Therefore

- Dry period infections important
- Prevention possible but needed new strategies
- Possible to identify herds with DP problems
Different approach to mastitis control?
Outline of approach

“Diagnosis”

Must

Should

Could

Action Points
Randomised clinical trial

Funded by DairyCo (MDC)

52 herd study – half received new approach

"Diagnosis"

Must

Should

Could

Action Points


National intervention study of mastitis control in dairy herds in England and Wales.

Green MJ, Leach KA, Breen JE, Green LE, Bradley AJ.

School of Veterinary Medicine and Science, University of Nottingham, Sutton Bonington Campus, Sutton Bonington LE12 5RD, UK.
Results

Proportional Change in Incidence Rate of Cows Affected

-0.4
-0.35
-0.3
-0.25
-0.2
-0.15
-0.1
-0.05
0

Control Farms
Compliance < 1/3
Compliance 1/3 - 2/3
Compliance > 2/3
Could this be used on a widespread scale?
Pilot study

20 vets selected by their farmers
A National Mastitis Control Scheme

DairyCo Mastitis Control Plan
• In October 2008 – nationwide...

• First participants trained to use the DMCP in April 2009

• Changes
  – Bespoke software
  – Supporting materials
  – A website was developed to support implementation of the Plan
How is it going?

Target number plan participants trained in 3 years
= 150 \textbf{267}

Target number of farms in first three years
= 750 \textbf{970 (1025)}

\textgreater 15\% of British cows are on farms that received the plan
How is it going?

Achieving approx a 10% improvement in mastitis in 1 year.
DairyCo Mastitis Control Plan

www.mastitiscontrolplan.co.uk

27 Apr 2012 – Welcome to the DairyCo Mastitis Control Plan website, part of a national mastitis initiative developed by veterinary surgeons and supported by...

Plan Users
Welcome to the Plan User area of the DairyCo Mastitis Control...

Contact Us
DairyCo Mastitis Control Plan
Home - Farmers - Plan Users...

Help
This site does not have buttons to increase/decrease the size of...

Registered Plan Users
Use the interactive map below to locate Plan Users near you...

Farmers
Welcome to the farmer area of the DairyCo Mastitis Control Plan...

Diary of Events
Courses and events that relate to bovine mastitis control and...

More results from mastitiscontrolplan.co.uk

The DairyCo Mastitis Control Plan
www.dairyco.org.uk/dairyco-mastitis-control-plan.aspx

The DairyCo Mastitis Control Plan. Visit the DairyCo Mastitis Control Plan. Mastitis Control Plan. Whilst mastitis in cattle is well controlled in an historical context, ...

DairyCo Mastitis Control Plan

1 Nov 2006 – DairyCo mastitis control plan. Spring 2008 will see the launch of the new DairyCo Mastitis Control Plan. The Plan is the result of years of work...

Mastitis - DairyCo
www.dairyco.org.uk/farminginfo/cone/health/mastitis.aspx

DairyCo Mastitis Control Plan - Pathogens - The cause of mastitis - Symptoms of mastitis - Working Arena - prevention of infection - Records/Tools - 2 Point Plan...

Mastitis Control Plan Update - DairyCo

DairyCo Mastitis Control Plan Update. Published 20 October 05. Dairy farmers should beware of jumping on the latest trend in order to cure high cell counts and mastitis, ...

Dairy Co Mastitis Control Plan from Hale Veterinary Group
www.haleveterinaryhospital.co.uk/dairyco-mastitis-control-plan...

Hale Veterinary Group
www.haleveterinaryhospital.co.uk

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Dairy Co Mastitis Control Plan

Mastitis is one of the major costs to the UK dairy industry, along with lameness and poor fertility, so control is extremely important. In order to develop an effective control strategy for mastitis, you must first determine what organisms are responsible for it and what risk factors are present. The Dairy Co Mastitis Control Plan is designed to help vets assess the risk factors for mastitis present on a farm and develop a control strategy for managing those risk factors. Lucy is a registered user of the Dairy Co Mastitis Control Plan.
FARM FOCUS VISITS - Kilco
www.kilco.co.uk/information/latest-news/farm-focus-visits
Andrew outlined the Dairy Co. Mastitis Control Plan which can be summarised as follows: 1. Diagnose Mastitis patterns from clinical Mastitis and somatic cell ...

Deliverers - Healthy Livestock
www.healthylivestock.org/paged.php?id=2317
To deliver on the mastitis or lameness* strands, you will need to attend a DairyCo Mastitis Control Plan or DairyCo Healthy Feet training course respectively.

Mastitis control, Endell Veterinary Group
www.endellveterinarygroup.co.uk/fs-mast.htm
We combine this with up-to-date knowledge and application of the DairyCo Mastitis Control Plan whilst being supported by our onsite laboratory. A summary and ...

DairyCo Mastitis Control Plan (2 Days) - Vet Surgeon
www.vetsurgeon.org/.../19-Jan-11-04-00-dairyco-mastitis-control-pl...
10 Jan 2011 – DairyCo Mastitis Control Plan (2 Days). As well as qualifying as CPD, additional material will be available including access to electronic ...

Mast Check - The Clover Group
www.clovergroup.eu/mastcheck.html
The system is based on the well publicised DairyCo Mastitis Control Plan. Masti Check provides a transferable method for addressing mastitis problems and ...

Fenwold Veterinary Practice Ltd :: Services - Farm Animals
www.fenwold-vets.co.uk/services3.htm
Fenwold Veterinary Practice has 2 registered and qualified users of the Dairy Co Mastitis Control Plan. For more information please contact the Spilsby branch ...

[PDF] St Davids November 10.qxp; St Davids
www.stdavids-farmvets.co.uk/.../2010_november_stdavids_newslette...
File Format: PDF/Adobe Acrobat - Quick View
DairyCo mastitis control plan. In this issue: Healthy Livestock Project / Ventilation of calf housing / Raw material update. Tony recently became a certified ...

[PDF] TIMETABLE of EVENTS - British Mastitis Conference
File Format: PDF/Adobe Acrobat - Quick View
Mark Stott, Veterinary Surgeon
www.highgate-vets.co.uk/staff/mark-stott.htm
I'm also a registered user of the DairyCo Mastitis Control Plan and the Rural Development Programme for England (RDPE) North-West Livestock Programme.

Udder Health and Communication - Google Books Result
books.google.co.uk/books?isbn=9058681857
In terms of who delivers the DairyCo control programme on farm, it was decided ... and then become official 'DairyCo Mastitis Control Plan' (DMCP) deliverers.

Mastitis Plan is Well Ahead of its Schedule - western morning news
westernmorning-news.vlex.co.uk.../mastitis-plan-well-ahead-its-sch...
7 Jul 2010 - Mastitis Plan is Well Ahead of its Schedule - western morning news - July 07, 2010 - Id: 212662675 - The DairyCo Mastitis Control Plan is now ...

DairyCo tackling lameness one step at a time - News - Livestock...
livestockwv.co.uk/.../dairyco_tackling_lameness_one_step_at_a_time...
1 Sep 2011 – Taking the learning from the DairyCo Mastitis Control Plan and the Healthy Feet Project at Bristol, the programme gives farmers the opportunity ...

Other Projects - SWHUL
www.swhul.co.uk/Resources/page_1.php?id=3104
DairyCo provides a national strategy and evidenced based plan for the control of mastitis in dairy cattle through the Mastitis Control Plan. Working with your vet ...

PROF Mastitis - Dairy Event and Livestock Show
livestockshowevent.co.uk/.../Mastitis%20Presentation%202011.pdf
File Format: PDF/Adobe Acrobat - Quick View
Farm team and vet/consultant/nutritionist - Reviewing management; making changes. - E.g. DairyCo mastitis control plan. - BUT don't just make changes for the ...

Twitter / MyVetMedFarm: DairyCo Mastitis Control Plan
twitter.com/MyVetMedFarm/status/28217921608397752
DairyCo Mastitis Control Plan - check it out at www.mastitiscontrol.co.uk or ask your vet. Reply: RetweetedRetweet; Delete; FavoritedFavorite. 2:30 PM - 20 Jan ...

PROF Three pages of RDPE Skills Training Opportunities Managing ...
www.reaseheath.ac.uk/wsc/.../RADA-Newsletter-September-2011.pdf

One Voice for Dairy Welfare

Dairy Cow Welfare Strategy
Summary
If you have any comments or queries please contact us at radiation@naturesvoice.org.uk

Dairy Cow Welfare Strategy

Cattle Health and Wellbeing Scheme
PO Box 9052
Kirkby-in-Ashfield
Nottingham
NG15 8AY
ramuir@kava.co.uk

Meat Trade News Daily

UK - Dealing with mastitis is dairy cows
08 Jul 2010

The DairyCo Mastitis Control Plan is now in place on 375 farms across the UK - ahead of target for the three-year project, which began in 2006.
What are dairy farmers doing to tackle mastitis?

The incidence of mastitis, an udder infection in dairy cattle, has declined since the introduction of an industry-wide programme, based on robust research, 40 years ago.

The UK has led the world in the control of mastitis and dairy farmers remain committed to reducing levels further. To comply with the Assured Dairy Farmers (ADF) scheme, farmers are required to have a herd health plan, which must include actions for preventing mastitis, and dairy farmers are also implementing an industry-wide control plan to help them recognise and act on the symptoms early.

Startvac: A New Vaccine to Reduce Mastitis

The good news:
- Helps prevent mastitis caused by E. coli, coiforms, Staph aureus, Staph spp.
- Reduces clinical and sub clinical infections
- Reduces severity
- Reduces SCC

The not so good news:
- It is not effective against Strep uberis.

A course consists of 3 vaccinations, two before calving and one around 52 days post calving.

Where there is significant mastitis caused by Staph or E coli type organisms it is likely that Startvac will help. Vaccination should be considered as part of an overall assessment of mastitis and SCC on farm.

DairyCo Mastitis Investigation

Now is an ideal time to review your approach to mastitis, its treatment and prevention via the Health Livestock funding. For more information speak to Nich or Neil.
• Support and promotion of the scheme by the major retailers, regional funding bodies and also farmer and veterinary bodies.
A National Mastitis Control Scheme

10-20% improvement pa?

...still a way to go...
On-going research...

- Host pathogen interactions
- Virulence and vaccines
- Molecular epidemiology (strain specific infection patterns)
- Understanding infection patterns to prevent mastitis
- Pathogen transmission and the cost of mastitis
- Prevention of dry period infections
- Heifer mastitis – repercussions
On-going research...

Enhancing decision making for mastitis control

Risk factor studies

Optimising decisions on disease prevention

Clinical trials

National Scheme part 2:
Research

National control scheme
Acknowledgements

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• James Breen, Chris Hudson, Katherine Leach, Laura Green, Jon Huxley, Aurelien Madouasse
• Jamie Leigh, Tracey Coffey, Richard Emes, Jasmeet Kaler

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  - Wellcome Trust
  - DairyCo
  - BBSRC
  - Leo AH
  - Bimeda AH
  - Pfizer AH