Teagasc
Agriculture and Food Development Authority

Moorepark Milk Quality Conference

Achieving Premium Quality Milk

Horse and Jockey Hotel

December 4th 2013

Department of Agriculture, Fisheries and Food
An Roinn Talmhaíochta, Iascaigh agus Bia

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Programme

9.00 – 9.30	Registration and Coffee
9.30 – 9.45	Introduction/launch DVD on milk quality
	Pat Dillon, Teagasc, Moorepark

Session 1: Food Industry

Chairperson: Tom Beresford, Teagasc, Moorepark

9.45 – 10.05	The role of the NDC and the milk quality awards
	Zoe Kavanagh, National Dairy Council
10.05 – 10.25	The importance of milk quality for the infant milk formula industry
	Mark Fenelon, Teagasc, Moorepark
10.25 – 10.45	The IDB/Moorepark Cheese programme
	Diarmuid Sheehan, Teagasc, Moorepark
10.45 – 10.55	Discussion
10.55 – 11.15	Coffee break

Session 2: Bacterial quality of milk

Chairperson: Pamela Ruegg Wisconsin University, USA

11.15 – 11.40	The 'moving window' - a new approach to food safety
	Claus Heggum, Danish Agriculture and Food Council, Denmark
11.40 – 11.55	Farm factors important in the control of *Bacillus cereus*

	Aine O'Connell, Teagasc, Moorepark
11.55 – 12.10	Dairy quality assurance scheme
	Michael Maloney, Bord Bia
12.10 – 12.30	National trends in bacterial numbers in milk
	David Gleeson, Teagasc, Moorepark
12.30 – 12.40	Discussion
12.40 – 14.00	Lunch

Session 3: Residues in milk

Chairperson: Martin Danaher, Teagasc, Ashtown

14.00 – 14.15	Overview of significance of residues in milk
	Michael Hickey, Dairy & Food Consultancy, Charleville, Co. Cork
14.15 – 14.30	Iodine residues in milk
	Bernadette O'Brien, Teagasc, Moorepark
14.30 – 14.45	Depletion of flukicides in milk and the transfer to dairy products
	Clare Power, Teagasc, Moorepark/Carlow Institute of Technology
14.45 – 15.00	Survey of chemical residues in milk in the Cork Harbour Region.
	Jim Buckley, formerly of Cork County Council
15.00 – 15.10	Discussion
15.10 – 15.30	Tea/Coffee

Session 4: Milk somatic cell count

Chairperson: Tom O Dwyer, Head of Dairy Knowledge Transfer, Teagasc

15.30 – 16.00	Understanding and using SCC to improve milk quality Pamela Ruegg, Wisconsin-Madison University, USA
16.00 – 16.15	CellCheck – an approach to reducing SCC in Irish herds Finola McCoy, Animal Health Ireland, Carrick-on-Shannon Co. Leitrim
16.15– 16.30	The potential cost savings of reduced SCC Laurence Shalloo, Teagasc, Moorepark
16.30 – 16.40	Discussion

Session 5: Panel discussion

Chairperson: Jack Kennedy, Dairy editor, Irish Farmers Journal

16.40 – 17.00	Panel discussion with Pat Dillon, Tom Berseford, Teagasc, Moorepark. Pamela Ruegg, Wisconsin, USA and Claus Heggum, Denmark.

Preface

A critical prerequisite for the manufacture of quality dairy products is to start with milk of the highest quality. Abolition of EU milk quotas in 2015 is projected to result in a 2.75 billion litre increase in Irish milk production by 2020. This increase has the potential to put pressure on the current quality standards, while the milk quality criteria requested by milk processors and by customers generally are becoming more strict and rigorous. It is important that requests to milk producers for improved quality milk is accompanied by the necessary information required to produce such improved quality milk.

This conference is the latest in a series of initiatives by Teagasc, Moorepark to provide with the necessary knowledge and support to maintain current milk quality standards and improve them. It is a direct result of interaction with the dairy industry partners through the Milk and Product Quality Forum, a group that meets bi-annually to identify and discuss issues of milk quality. More detail on other initiatives can be seen at http://www.agresearch.teagasc.ie/moorepark/milkquality/.

We would like to thank all the presenters, and the contributions of those who contributed to the work being presented. In particular we would like to thank the international guest speakers for their time and for contributing an international perspective.

Finally, Volume 52 No. 2 of The Irish Journal of Agricultural and Food Research is dedicated to the presentations from the conference. This issue of the Journal will be available in January 2014 and will be distributed to all conference attendees.

Kieran Jordan, David Gleeson and Bernadette O'Brien

Conference organisers

The role of the NDC and the milk quality awards

Zoe Kavanagh

National Dairy Council, Sandyford Industrial Estate, Dublin 18

NDC Vision

To give consumers of all ages compelling reasons to stock their fridges every day with a range of quality fresh Irish dairy products for everyone to enjoy.

NDC Mission

To deliver real and unique value to Irish dairy farmers by protecting and promoting the image, quality, taste and nutritional credentials of Irish dairy produce to a wide variety of audiences in a clearly defined, focussed, unique and effective manner.

Consistent with and underpinning the mission of the organisation, the NDC aims to achieve the following by the end of 2015:

1. To work toward a dairy industry standing for quality, sustainability and excellence in dairy farming and therefore well positioned to exploit abolition of milk quotas
2. To ensure a strong robust NDC mark clearly differentiating Republic of Ireland milk for consumers and retailers
3. To deliver strategically sound and excellently executed marketing and promotion plans for dairy produce.
4. To successfully protect and enhance the reputation of the dairy industry
5. To build clear and unambiguous consumer cut through on the nutrition and health benefits of milk and dairy as part of a balanced diet and healthy lifestyle
6. To maintain expert status on developments in dairy nutrition and to maintain recognition as an industry lynchpin
7. To deliver value for money on all activities

The importance of milk quality for the infant milk formula industry

Mark Fenelon

Teagasc, Moorepark, Fermoy, Co Cork

A primary objective of any infant formula manufacturer is to produce products which adhere to the highest quality standards. Since dairy based ingredients are used in most infant formulations, the overall quality of the milk from which these ingredients are derived is of significant importance. The aim of this presentation is to describe the key areas and infrastructure which are required to keep Ireland at the forefront for supply of dairy ingredients to the infant formula sector. From the perspective of the infant formula manufacturer, quality embraces compositional variations, microbiology, residues and contaminants as they affect not alone milk but also milk ingredients such as skim and whey powders.

The quality of nutrients in milk is a key determinant of the physical stability of infant formulations throughout processing. Particularly milk protein as it has a dual role in that it forms a nutritional base and is also responsible for giving colloidal stability throughout processing. Proteins are key emulsifiers and their interactions with minerals largely control thermal stability of formulations. There are multiple parameters to be realised while identifying the quality attributes needed for selection of milk for manufacturing infant formula and these include preservation of key nutritional benefits of the vulnerable neonate and ensuring optimised physical stability in both liquid concentrate and finished powder (e.g., viscosity). New studies currently being carried out at Teagasc are addressing the effects of animal nutrition and milk composition (quality) on the functionality of milk for use in infant formula.

The IDB/Moorepark Cheese programme

Diarmuid Sheehan

Teagasc, Moorepark, *Fermoy, Co. Cork.*

Abolition of EU milk quotas in 2015 is projected to result in a 2.75 billion litre increase in Irish milk production by 2020. Although cheese offers vital market opportunities for this increased milk production, traditional cheese markets such as Cheddar, are predicted to grow more slowly than for other semi-soft and semi-hard cheese types. Innovation is now focused on achieving greater diversity in cheese types manufactured on Irish commercial plants and on development of new products with specific properties for target markets. This innovation is best illustrated by the current Teagasc - Irish Dairy Board collaboration. This review considers the relative influence of milk quality on diversification of the portfolio of cheeses manufactured from a seasonally produced Irish milk supply with particular reference to milk microbial profile, milk enzyme complement and the physiochemical quality of milk for the manufacture and ripening of non-Cheddar cheese varieties.

Use of the moving window approach for the verification of HACCP/GHP systems

Claus Heggum

Danish Agriculture and Food Council, Denmark

In a food business, microbiological testing is one of several methods of verifying the performance and acceptability of the entire food safety system. Demonstrating compliance with microbiological criteria applicable for end products through the *moving window* approach is a practical and cost beneficial way for well-managed Hazard Analysis & Critical Control (HACCP) systems.

This presentation discusses the *moving window*s approach and provides illustrated examples on how the approach can be used by any Food Business Operator (FBO) to verify compliance over time with a Microbiological Criterion (MC) applicable to end products manufactured within a HACCP-based food safety control system.

The sampling approach consists of sampling a defined number of analytical units, at a specified frequency over a defined time period. Compliance with the MC is demonstrated when (i) the specified absolute maximum level of acceptability (*M*) is not exceeded and (ii) any specified maximum frequency (*c*) of samples taken during a specified period (*n*) do not exceed a marginally acceptable maximum level (*m*). Follow-up action on individual results is triggered by exceeding these limits which depending on type of organism may include actions on affected lots such as withdrawal/recall and/or reviewing the monitoring records and action on the HACCP system.

Highlights

The *moving window* approach:

- is a cost beneficial way to demonstrate compliance with MC,
- can demonstrate acceptable performance of HACCP systems, and
- when used together with trend analysis, optimizes verification over time.

Farm factors important in the control of *Bacillus cereus*

Aine O'Connell

Teagasc, Moorepark, Fermoy, Co Cork

The objective of this study was to determine the on-farm management factors that are associated with the *Bacillus cereus* count in raw bulk tank milk using a cross sectional study design. Bulk tank milk quality was monitored for *B. cereus* on 63 dairy farms between July and August 2012. Bulk tank milk samples corresponding with processor milk collection dates were taken over a two week period prior to the farm visit and tested for *B. cereus.* The four most recent samples taken prior to the on-farm visit were averaged and log transformed to give the outcome variable; mean $\log_{10}$ *B. cereus* cfu/ml. On-farm data collection included recording observations and providing a questionnaire on basic hygiene, management factors and cow hygiene scoring. All independent variables were analysed individually with the outcome variable using simple linear regression and one way ANOVA; a multivariable regression model was subsequently developed. Only significant variables were retained in the final model ($P<0.05$). The geometric mean *B. cereus* count for all farms was 40 cfu/ml. The start temperature of the cleaning solution wash, dry wiping teats prior to unit application, the feeding of silage and re-using the cleaning solution more than once were all unconditionally associated ($P<0.10$) with the *B. cereus* count in bulk tank milk but did not enter the final multivariable model. *B. cereus* count was four times greater (201 cfu/ml) when cows had been housed compared to when they were on pasture (50 cfu/ml). The allocation of fresh grass every 12 h (62 cfu/ml) resulted in a decrease in *B. cereus* count (166 cfu/ml every 24 h or greater). The testing of water for bacteriology was associated with an increase in *B. cereus* count. In conclusion, this study highlights specific management factors associated with the *B. cereus* count in bulk tank milk.

Dairy quality assurance scheme

Michael Maloney

An Bord Bia, Clanwilliam Court, Lower Mount St, Dublin

According to research from the EC Joint Research Centre Irish dairy farms have the joint lowest carbon footprint for milk in the EU. However, increasingly purchasers of Irish dairy products are requiring proof that the milk is produced sustainably on farms. In response to these market demands Bord Bia and the dairy industry have developed an accredited quality assurance scheme which also incorporates the systematic collection of data which will provide proof of both the sustainability and quality assurance credentials. This presentation will outline the details of this first national quality assurance scheme for dairy farmers.

Milk quality trends in Ireland 2006-2011

David Gleeson

Teagasc, Moorepark, Fermoy, Co. Cork.

The success of the Irish dairy industry is reliant on maintaining and expanding international markets for dairy products. Improvements in milk quality and udder health are fundamental to retaining the competitive advantage of the industry, especially in the manufacture of high-value dairy products. With this in mind, the objective of this study was to assess current trends in bulk tank milk quality between 2006 and 2011. Individual farm milk quality data including bulk tank SCC, TBC and milk volume data were supplied by ten milk processors. One complete LPC dataset from one processor was used for analysis. Data were edited for accuracy and data from farms that supplied milk for <6 months per year or not present for all years were deleted. For analysis, SCC, TBC and LPC were log transformed to achieve normality. Analysis was performed using mixed models with herd included as a random effect and processor, year and month as fixed effects. Records from 11,444 farms representing 64% of Irish dairy farms were used for analysis. The final dataset included 687,767, 625,615 and 200,883 records for SCC, TBC and LPC, respectively. Throughout the entire study period geometric mean SCC in the national herd improved only slightly (298,057 to 271,456 cells/ ml) and the monthly SCC ranged from 256,448 cells/ ml in May to 376,617 cells/ml in December. Herds that sold the least amount of milk annually tended to have the highest SCC. The annual trend for TBC remained stagnant throughout years with TBC decreasing by 500 cfu/ml during the entire period. A seasonal effect is seen in monthly TBC where TBC increases during the early spring and winter periods (26,000 cfu/ml) and is lowest during the summer period (18,000 cfu/ml). During the study period, LPC increased from 197 to 268 CFU/ ml. The lowest monthly LPC count was observed in March (175 CFU/ ml) followed by an increase from April to October (296 CFU/ ml). Minimal changes in both SCC and TBC occurred during the period 2006 to 2011.

Overview of significance of residues in milk

Michael Hickey

Dairy & Food Consultancy, Charleville, Co. Cork

Residues chemical contaminants in milk may be introduced throughout the food chain. In the case of milk products these may come from feed and forage, in milk production, milking, transport, processing and packaging. These residues may come from the environment, additive use, industrial pollution (including emissions, accidents and waste), mycotoxins, pesticides, veterinary drugs, radionuclides, cleaning chemicals, by-products of heat treatment (HEATOX) and migration from packaging materials. There are many examples of such food contamination over the years. These include examples of deliberate contamination for fraudulent purposes (e.g. melamine). For convenience the subject of residues in food (including milk) can be addressed under 3 main headings, chemical contaminants, the approved use and potential resultant residues of pesticides used in agriculture and the approval and potential resultant residues of veterinary drugs in animals. The use of substances prohibited for use in food production has also to be considered. The bioconcentration (both bio-magnification and bioaccumulation) of some specific contaminants called Persistent Organic Pollutants (POPs) and some heavy metals are topics of particular attention and concern.

To address the potential of residues causing risks to human health, risk analysis, consisting of risk assessment, risk management and risk communication has been used at international, regional and national levels. Standards and legislation have been elaborated, including specified maximum residue limits (MRLs), to minimise the risks to human health and to manage and monitor the effectiveness of controls put in place. Consequently many countries, including Ireland, have specific national residue monitoring programmes in place for animal products, including milk. Laboratories play a key role in this risk management framework. Among the challenges for laboratories are that many maximum residue limits (MRLs) are at, or near, the limits of detection of current methodology. Current monitoring strategies rely mainly on targeted approaches but there is an emerging trend towards using untargeted strategies, which rely on finding and using biomarkers of treatment or contamination residues (sometimes referred to as “advanced ‘omics” approaches).

Iodine residues in milk

Bernadette O'Brien
Teagasc, Moorepark, Fermoy, Co Cork

Iodine tends to be supplemented at farm level in the expectation of increasing cow health and fertility. There is concern that such practises may result in high milk iodine, which could affect ingredients for infant formula and, thus, dairy export markets. The objective of this study was to quantify the effect of iodine fortified and teat disinfection practices of dairy cows on milk iodine concentration. Thirty lactating cows were fed 7 kg, 3 kg (10 mg iodine/kg) and 0 kg of concentrate feed during 3 periods of 35 days each. During the first 14 days of each period, cows were on dietary iodine treatments only; during days 15-21, one of three teat disinfection treatments (n=10) was applied (in addition to the dietary iodine treatments): non-iodine (chlorhexidine) post-milking spray; 0.5% iodine spray post-milking; 0.5% iodine spray pre- and post-milking. Cow milk yield was 21.3 kg/day. Individual cow milk samples were analysed for iodine concentration on 2 days at the end of each treatment period. Dietary supplementation of iodine at both 30 mg and 70 mg per day increased milk iodine concentrations significantly ($P<0.001$) from 155 to 474 and 511 µg/kg, respectively. Teat disinfection both pre and post milking increased milk iodine concentration at each of the dietary supplementation levels of 0, 30 and 70 mg/day compared with a non-iodine teat disinfectant ($P<0.001$). In conclusion, both dietary iodine supplementation and teat disinfection iodine increased milk iodine concentrations in an additive manner, exceeding common target values of 250 µg/kg. As both iodine treatments can occur simultaneously on farm, supplementation strategies should be monitored.

Depletion of flukicides in milk and the transfer to dairy products

Clare Power

Teagasc, Moorepark, Fermoy, Cork/Carlow Institute of Technology, Carlow

Flukicides are widely used to treat infestations of liver fluke in dairy cattle. This could result in flukicide residues in milk if animals are improperly treated or if withdrawal periods not properly observed. The purpose of this review is to summarise the results of studies on depletion of flukicides from milk and the transfer of flukicide residues to dairy products, if present in the milk. As the depletion of flukicide residues from milk of animals treated during lactation was relatively slow, the studies support the view that the dry period (when milk is not being used for human consumption) is the most suitable time for flukicide treatment. Migration of residues to product occurred at different rates, depending on the drug in question. Generally, concentration of flukicides occurred in cheese, butter and skim milk powder. Pasteurisation or heat treatment during spray drying had no impact in reducing residues.

Animal Health Surveillance of Dairy Herds in the vicinity of a large industrial chemical cluster in the Cork Harbour Region.

Jim Buckley
formerly Cork County Council

County Cork has a diverse socio-economic infrastructure consisting of agriculture, industry and tourism. The county accounts for approximately 29% of gross agricultural output and 25% of the dairy output of Republic of Ireland. The Cork area experienced a rapid expansion of the pharmaceutical industry in the late 1980s /early 1990s with a large number of international chemical industries establishing manufacturing plants in the Cork Harbour region and surrounding regions.

Dairy cows residing in the region are considered to be appropriate indicators of the quality of the ambient environment, and they are also significant contributors to the human food chain both through milk and meat supplied. Toxic chemicals, if present in the environment, may bio-accumulate in over time.

The overall findings of this study indicated that for 'Markers of Effects' there was no evidence, on the basis of comparison of control and target herd results, that there was any adverse effect of location on clinical pathology parameters. In addition, for 'Markers of Exposure', the reduction in total dioxins in milk produced in the Cork Harbour catchment and adjacent areas is similar to the findings of other studies in the UK and Ireland for the same period.

The programme is coordinated by the Veterinary Department, Cork County Council, on behalf of the Environmental Protection Agency and is funded by way of contributions from industrial operators under the terms of their respective Integrated Pollution Prevention & Control (IPPC) licences.

Understanding and using SCC to improve milk quality

Pamela Ruegg

Wisconsin-Madison University, USA

The production of high quality milk is a requirement to sustain a profitable dairy industry and somatic cell count (SCC) values are routinely used to identify subclinical mastitis and define quality standards. The objective of this paper is to review the use of SCC as a diagnostic tool for subclinical mastitis in order to improve milk quality on dairy farms. Mastitis is detected based on inflammation subsequent to intramammary infection (IMI) by pathogenic organisms. Individual cow SCC values are used to detect the inflammation that results from IMI and are necessary to define the prevalence and incidence of subclinical IMI. A threshold of <200,000 cells/ ml is considered to be of the most practical value used to define a mammary quarter as healthy. The development of IMI is the most significant factor that influences milk SCC and assessment of monthly values to determine newly and chronically increased SCC can be highly diagnostic for resolving problems with increased bulk tank SCC. Methods to reduce the development of new IMI are well known and adoption of best management practices for milking and herd management have consistently been shown to result in reductions in bulk tank SCC. Implementation of mastitis control programmes can be improved by focusing on three practical recommendations: 1) Farmers should work with their advisors to develop an annual udder health plan that includes clear goals for milk quality. 2) The annual udder health plan should emphasise prevention of new IMI. 3) Farmers must identify and manage chronically infected cows. Proactive management of IMI can be extremely effective in helping farmers produce milk that meets industry standards for milk quality.

CellCheck-the national udder health programme in Ireland

Finola McCoy

Animal Health Ireland, Carrick-on-Shannon, Co. Leitrim

Traditionally in Ireland, regulatory animal health issues (such as TB, Brucellosis and FMD) have been the responsibility of the government, with little or no coordination around non-regulatory animal diseases. However, the establishment of Animal Health Ireland (AHI), is helping to address this gap. AHI has identified mastitis as one of seven priority disease areas, and a national udder health programme called CellCheck was initiated at the end of 2010. The objectives of the CellCheck programme are setting goals, building awareness, establishing best practice, building capacity and evaluating change. CellCheck has been shaped by both national and international research and experience. Previous research in Ireland, such as the €uroMilk pilot mastitis control programme, has helped to identify some of the obstacles to improving udder health, that exist at farm level. The key strengths of CellCheck are its multidisciplinary and collaborative nature, involving all relevant industry bodies in both the development and delivery of the programme.

Examining the impact of mastitis on the profitability of the Irish dairy industry

Laurence Shalloo

Teagasc, Moorepark, Fermoy, Co. Cork

Mastitis was identified as a priority disease within the Irish dairy industry by both dairy farmers and industry animal health experts, which led to the development of the CellCheck programme. In order to support this programme it was necessary to understand the extent to which mastitis affects farm profit, processor returns and ultimately industry profitability. To this end, an analysis of the impact of mastitis on farm, processor and the overall industry profitability was carried out. The impact of mastitis on farm costs, farm receipts and farm profitability are presented across a range of bulk milk somatic cell count (SCC) categories from <100,000 to >400,000 cells/ml. A meta-analysis of the relationship between SCC and raw milk composition, cheese processing characteristics and cheese composition was carried out and utilised to establish the impact of mastitis on processor returns. As SCC increased the impact of mastitis on the volume of product that could be produced, net processor returns, milk price and the values per kg of fat and protein were calculated. The farm and processor analysis were then combined to estimate the impact of mastitis on the Irish dairy industry returns, accounting for both farm and processor costs. The analysis suggests that as cell count reduced from >400,000 to <100,000 cells/ml, overall returns to the farm should increase by 4.8 c/l, including the farm and processor related effects. Nationally, if the cell count was reduced by 10%, it would be worth €37.6 million for the Irish dairy industry.