Presenting technologies to deliver sustainable dairy farming

Friday 21st June 2019, House of Commons, London
Contents

Preface 01
LEAF Overview 02
Speaker Profiles 03 – 05
Forage Innovation 06
Sustainably Milk Production Case Study 07
Paper References 08
Forage is the key to business resilience

Pressure on the livestock farming industry to supply food sustainably is now at unprecedented levels.

True sustainability requires financially viable farm businesses, produce that meets the requirements of the consumer, and production systems that are environmentally responsible.

With climate change high on political and social agendas, probably indefinitely, environmental issues are without doubt going to become more and more a feature of farming sustainability. For the dairy sector specifically, there is a spotlight on greenhouse gas emissions, especially methane and nitrous oxide, and the contribution they make to a farm’s overall carbon footprint.

Ammonia emissions from livestock contribute to the air pollution that has been identified by Government as the ‘top environmental risk to human health’. At present, measures to reduce emissions are included in a Code of Good Agricultural Practice, supporting the Government’s Clean Air Strategy. This is currently a voluntary code, but – with air quality targets to be met within little more than a decade – there is the inescapable prospect of more direct action in the future.

Today’s presentation offers the industry great reasons for optimism, highlighting opportunities to reduce dairy farming emissions significantly using currently available technologies.

As our keynote paper reveals, simply using ryegrasses bred to have higher water soluble carbohydrate content can improve nitrogen use efficiency and reduce nitrogenous waste, thereby reducing carbon footprint by up to 6 %, whilst simultaneously improving production efficiency. Greater reductions in carbon footprint are possible where use of these modern ryegrasses is combined with improved manure management practices.

The conference is aimed at policy makers and opinion leaders representing all parts of the milk production chain and intends to help the industry take tangible steps towards a more sustainable future.

Paul Billings
Managing director
Germinal GB
Caroline Drummond MBE
Chief Executive of LEAF

Caroline has been running LEAF, (Linking Environment And Farming) the leading organisation delivering more sustainable food and farming since it started in 1991. LEAF works with farmers, the food industry, scientists and consumers to inspire and enable sustainable farming that is prosperous, enriches the environment and engages local communities, through its network of Demonstration Farms, management tools, the LEAF Marque and the education and public engagement activities such as LEAF Open Farm Sunday and FaceTime A Farmer. She is especially interested in the development of sustainable food and farming and she has over 38 years experience in this area.

She graduated in Agriculture and has broad practical agricultural experience from across the globe. Her work focuses on encouraging more sustainable farming practices and building a better public trust and understanding of farming, food, health and the environment – values that she is personally extremely passionate about. She is actively involved in many industry partnerships and initiatives in the UK and Europe.

In 2009 Caroline was awarded the Member of the British Empire (MBE) by the Queen, she has an Honorary Doctorate from Harper Adams University, a Nuffield Scholarship studying ‘What can Farmers Learn from Science to improve the Nutrition of our Food’ and was awarded Honorary Fellowship for the Society of the Environment. In 2017 she was awarded the IAgE Award For Outstanding Contribution to the Landbased Sector and the Farmers Guardian Outstanding Contribution to Agriculture. In 2018 she was awarded the RASE National Agriculture Award and an Honorary Fellowship from the Royal Agricultural University. In 2019 she was awarded Women Economic Forum – Women of the Decade in Sustainable Farming.

Caroline is actively involved with the British Nutrition Foundation, North Wyke, the Agri-tech initiative – is a director of the Agri-tech centre on Crop Health And Protection, the Institute of Agriculture Management, and on the advisory board of the agricultural project for the Science Museum. In 2018 she sat on Dame Glenys Stacey’s advisory committee for the Farm Inspection and Regulation Report.

Caroline is married to a dairy farmer and they have a daughter.

Caroline Drummond MBE, Hon DSc, NSch,
HonFSE, FRAgS, FIAgM, FRSA, FSB, CEnv, BSc(Hons) Agric
Chief Executive of LEAF (Linking Environment And Farming)
Jon Moorby
Professor of Livestock Science

Jon Moorby is Professor of Livestock Science at the BBSRC Institute of Biological, Rural and Environmental Sciences (IBERS) and Director of Sustainable Farming Systems at Aberystwyth University. He gained a BA in Biological Sciences at Oxford in 1990 and a PhD in dairy cow nutrition at the Scottish Agricultural College (now Scotland’s Rural College) at Auchincruive, Ayr, in 1993.

Following that he moved to IBERS to continue research on dairy cow nutrition. His interests include optimising the use of home-grown forage-based diets for ruminant livestock and has developed research programmes with the institute’s plant breeders. He has worked to investigate the benefits of new forage plant varieties and define new breeding targets, with the specific goal of improving the efficiency of capture of plant nutrients into meat and milk, helping to reduce the outputs of pollutants such as methane and nitrogen that can be converted to ammonia and nitrous oxide.
Dave Styles
Lecturer in Life Cycle Assessment

Dave specialises in environmental and techno-economic assessment of food, bioproduct and waste management systems, and has 15 years of experience in life cycle assessment (LCA) at Trinity College Dublin, Ireland’s Environmental Protection Agency, the European Commission’s Joint Research Centre, Bangor University and NUI Galway.

He lectures on the Climate Change Agriculture and Food Security (CCAFS) MSc program at NUI Galway, and leads rapidly expanding research group in Bangor University evaluating novel value chains for plant-protein foods & animal feeds, dairy products, wood, miscanthus, anaerobic digestion and beers and spirits.

Dave is increasingly interested in tropical systems, and is currently involved in projects evaluating sustainable intensification strategies for tropical beef and dairy systems in Colombia and Costa Rica. He is member of the UN task force developing life cycle impact indicators for water and air pollution.

Dr David Styles
Lecturer in Life Cycle Assessment
School of Environment, Natural Resources and Geography
Bangor University
 Effects of high-sugar grasses and improved manure management on the environmental footprint of milk production at the farm level

Pasture-based milk is increasingly preferred by consumers owing to its perceived socio-economic, animal welfare and environmental benefits.

However, nitrogen excretion from pasture-based dairy farming is also a large source of nitrogen leaching and emission of the potent greenhouse gas nitrous oxide. Ryegrass bred to express elevated concentrations of water-soluble carbohydrates (‘high-sugar’ grass; HSG) has been shown to decrease dietary nitrogen excretion in urine of cattle, and may increase milk yields per cow, but it is unclear how this translates to environmental footprints at the farm- and product-levels.

This study evaluates, for the first time, the environmental footprint of HSG dairy systems with life cycle analysis, measured as land occupation in addition to global warming, eutrophication, acidification and resource depletion potentials (energy-based and economic allocation methods). Data from meta-analysis and simulation were combined to model a pasture-based dairy farm under a conventional perennial ryegrass-based scenario (Sc-CTR) and an HSG-based scenario (Sc-HSG). In addition, grass type interactions with six manure management permutations were considered, leading to 12 scenarios in total. It was found that eutrophication and acidification potentials per unit of energy-corrected milk could be reduced by 4–6% and 7–11% respectively when switching from Sc-CTR to Sc-HSG, and that these reductions could reach 22% and 40% respectively with more efficient manure management.

It is concluded that a simple change in choice of grazing sward may deliver substantial environmental gains, especially when combined with improved farm technology. However, the high costs for improving manure management could drive expansion of HSG pastures as a more attractive short-term measure for farmers, while regulation and access to capital could drive investment in improved manure storage infrastructure and spreading equipment.
Forage at the heart of future farming

As thought-leaders and innovators in forage, Germinal has a clear role in helping to drive forward agriculture to a brighter and more sustainable future. A global supplier of quality forage seeds, Germinal’s business is rooted in plant breeding and animal science, most notably through its longstanding association with the Institute of Biological, Environmental and Rural Sciences (IBERS), Aberystwyth University.

Germinal is a company that is moving forward and innovating for the future, as demonstrated by investment in its own Research Station and field trials programmes. This ground level research, alongside widespread industry collaborations, gives Germinal the knowledge and foresight to supply farmers the tools they need for future sustainable growth.

Forage innovation and leadership from Germinal:

- High water soluble carbohydrate ryegrasses (Aber High Sugar Grass); maximising performance from grass and minimising greenhouse gas emissions from livestock.
- More persistent white clover (e.g. AberLasting); increasing homegrown protein and reducing reliance on artificial fertilisers.
- Longer lasting red clover (e.g. AberClaret); increasing homegrown protein and reducing reliance on artificial fertilisers.
- Deep rooting festulolium hybrids (e.g. AberNiche); providing flood mitigation opportunities and drought tolerance.
- High utilisation forage brassicas; increasing homegrown feed supplies and underpinning low-cost out-wintering systems.
- Multi species swards; increasing performance from forage, adding bio-diversity and improving soil health.
Dairy farmer Robert Craig readily accepts that there is more than one route to sustainable milk production, but his method is to aim for 1 kilogram of milk solids per kilogram of cow liveweight per year from a grass-based system.

Across three units in Cumbria and Northumberland, he is managing 1,400 cows on around 820ha of grassland, some of which would be deemed ‘marginal’ land and a good proportion being unsuitable for growing arable crops efficiently.

“Our strategy is to grow the best grass that we can and to maximise what we produce from grazing, thereby keeping imported feed to a minimum,” says Robert. “Our mature cows are typically 500kg liveweight, so we’re targeting 500kg milk solids per lactation, with supplementary concentrates down as around 0.8 and 1.2 tonnes per cow.

“The biggest challenge to our sustainability is probably our reliance on artificial fertilisers, but with the use of white clover and better use of slurry we have the opportunity to reduce the nitrogen that we need to buy in.

“With technologies like high water soluble carbohydrate ryegrasses being readily available and use of equipment such as dribble bars having proven advantages, there are significant opportunities for our industry to become more efficient and to reduce its greenhouse gas emissions, therefore becoming more sustainable.”

Robert Craig is an RABDF council member and a director of First Milk.
<table>
<thead>
<tr>
<th>Publisher</th>
<th>Journal</th>
<th>Reference</th>
<th>Author</th>
<th>Year</th>
<th>Title</th>
<th>Institute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elsevier Ltd</td>
<td>Journal of Cleaner Production</td>
<td>202:1241-1252</td>
<td>Soteriades *, Gonzalez-Mejia *, Styles ***, Foskolos *, Moorby * and Gibbons **</td>
<td>2018</td>
<td>Effects of high-sugar grasses and improved manure management on the environmental footprint of milk production at farm level</td>
<td>* School of Natural Sciences, Bangor University</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>** Plant &amp; Agri-BioSciences Centre, Ryan Institute, NUI Galway</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>** IBERIS, Aberystwyth University</td>
</tr>
<tr>
<td>Oxford University Press</td>
<td>Journal of Animal Science</td>
<td>84:3061-3070</td>
<td>Lee, Connelly, Tweed, Dewhurst, Merry and Scollen</td>
<td>2006</td>
<td>Effects of high-sugar ryegrass silage and mixtures with red clover silage on rumen digestion: 2. Lipids</td>
<td>Institute of Grassland and Environmental Research, Aberystwyth</td>
</tr>
<tr>
<td>Oxford University Press</td>
<td>Journal of Animal Science</td>
<td>84:3049-3069</td>
<td>Merry, Lee, Davies, Dewhurst, Moorby, Scollen and Theodorou</td>
<td>2006</td>
<td>Effects of high-sugar ryegrass silage and mixtures with red clover silage on rumen digestion: 1. In vitro and in vivo studies of nitrogen utilisation</td>
<td>Institute of Grassland and Environmental Research, Aberystwyth</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>** Institute of Rural Studies, University of Wales, Aberystwyth</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>** Rowett Research Institute, Bucksburn, Aberdeen</td>
</tr>
</tbody>
</table>
Find out more

Should you require any more information or to request a selection of free brochures and technical guides, please visit our website:

www.germinal.co.uk

@GerminalUKAgri

Contacts:

Ben Wixey
National Agricultural Sales Manager
T: 07990 578550
Southern England and South Wales
T: 07713 878069

William Fleming
Scotland and North East England
T: 07971 640428

Helen Mathieu
Central, Eastern and North West England and North Wales
T: 07866 456056

Head office:
lincoln@germinal.co.uk