A VISION FOR DAIRY 2030

The UK dairy industry can reduce its environmental footprint by 30% over the next decade - how?

PROUD TO SUPPORT THE **BRITISH DAIRY INDUSTRY** FOR 20 YEARS

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Introduction

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In order to thrive, and survive, the UK dairy industry needs to change the way it operates over the next ten years. Environmental pressures, consumer trends and concerns, a shifting marketplace and new technologies will all impact on our industry. We cannot ignore this shift: we need to farm differently in the future and demonstrate this to protect and promote our industry.

Without a doubt, the biggest threat to dairy farming in the UK today is environmental. While the vegan lobby puts animal welfare at its heart, it's important to remember 'true' vegans make up a small percentage of consumers. While animal welfare will remain a concern, what we see is consumers' changing buying habits as they become increasingly concerned about the environmental impact of livestock farming, and dairy farming in particular.

Pressure has already started to come from consumers to change the way we farm, and political pressure is also increasing. We need to rapidly and proactively address this challenge to avoid a situation where there is a paradigm shift in consumer demand for dairy or where legislation makes dairy farming difficult in the UK.

As an industry we can reduce our greenhouse gas emission by 30% by the year 2030. This report demonstrates how we will do this.

Climate change policy is a key driver in the dairy industry

The pressure to change will be driven by government policy as it strives to deliver on its economy-wide pledge for carbon neutrality by 2050.

In January 2020, the Committee on Climate Change (CCC), the UK government's official climate adviser, published the report, *Land use: Policies for a Net Zero UK*. It highlighted major shifts in farming practices, agro-forestry and consumer behaviour required to decarbonise the UK's land sector to ensure it achieves its contribution to this Net Zero goal.

The latest version of the Agricultural Bill (January 2020) has also adopted the need for change. Over the next 10 years, payments to farmers will be redirected towards helping the government achieve its goal for carbon neutrality by 2050. These policy decisions will drive farming practices, including livestock numbers, in the next 10 years and beyond. CCC targets for land-based industries involve reducing emissions from land by 64% by 2050 as its contribution to carbon neutrality. In 2017 they represented 9% (56% of this was from ruminants, meaning 5-6% of UK's total GHG comes from beef, sheep and dairy) of the UK's total greenhouse gas emissions. The dairy industry will play a crucial role in ensuring these targets are achieved over the next 10 years.

The CCC recommends one fifth of all agricultural land should to be used to draw carbon from the atmosphere, i.e. by planting trees, restoring peatlands and soils and growing bioenergy crops with carbon capture and storage (BECCS). Timber and bioenergy crops would additionally contribute to further emissions cuts in other sectors of the economy.

The CCC report identified afforestation and agro-forestry as the biggest carbon-cutting measures. However, it also proposes a cut in consumption of perceived carbon-intensive food such as dairy, beef and lamb by at least 20% per person, and a reduction in food waste by 20%, by 2050 to help reduce methane emissions and release land for tree planting and growing bioenergy crops.

The challenge will be to balance land use for UK food production and reducing true carbon emissions. The risk exists that if there is an imbalance, and too much priority is given to the latter, it will only result in more food and chemical imports from countries less efficient in dairy or livestock production resulting in 'carbon leakage'. Nevertheless, it is clear climate change and environmental policy will require farmers to produce more milk from fewer cows in carbon-efficient production systems.

> ...helping the government achieve its goal for carbon neutrality by 2050.

Rising to the challenge

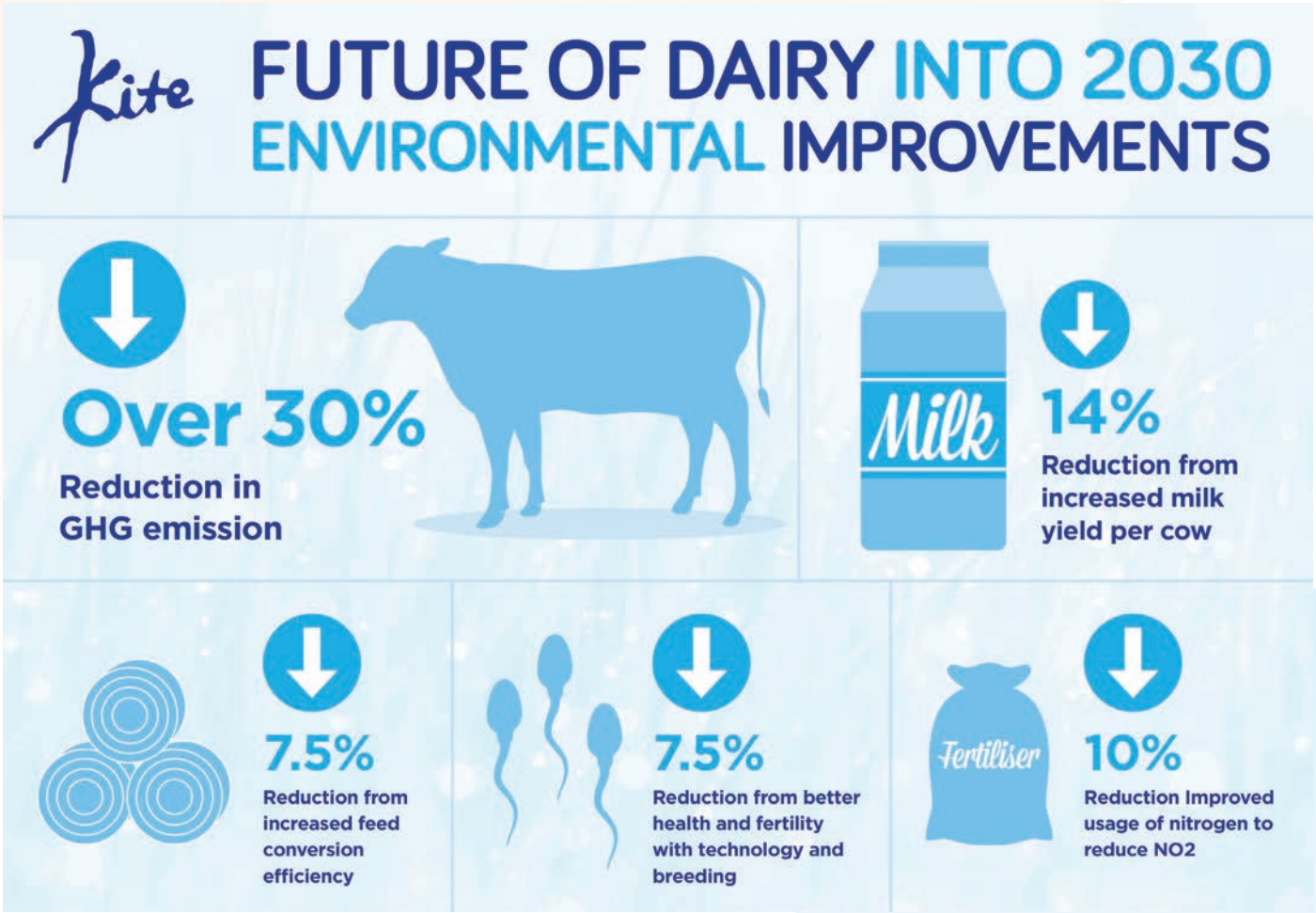
There is no doubt the UK dairy industry can rise to this challenge and reduce its environmental footprint while maintaining milk supply (or even increasing it if required by the industry and policy makers). We can do this by focusing on developing environmentally efficient animals and production systems and implementing change to current practices.

Fundamentally, the UK is a good place to produce milk. Our geography and infrastructure count in our favour. Our temperate, wet climate makes the UK an ideal place to grow the high-quality forage that can drive our systems. This forage is often grown in places no other crop would efficiently thrive. What's more, UK dairy producers are innovative, having learnt to live with uncertainty and challenge as a result of a volatile milk market over the past decade. They have shown themselves to be resilient, open to new ideas and adaptable.

We are an industry that can deliver a significant reduction in greenhouse gas emission through science, technology and good management, and by using the latest innovations and developments. Change of this scale requires a different way of thinking. Some of the options may not be popular with every farmer - for example, the adoption of more mixed farming practices or even taking some land out of agricultural production. However, unless we drive the change required, the industry will be forced to change and it is better to drive progress and maintain public trust, than be seen as environmental laggards, potentially damaging the reputation of the industry.

How to deliver the 30% reduction

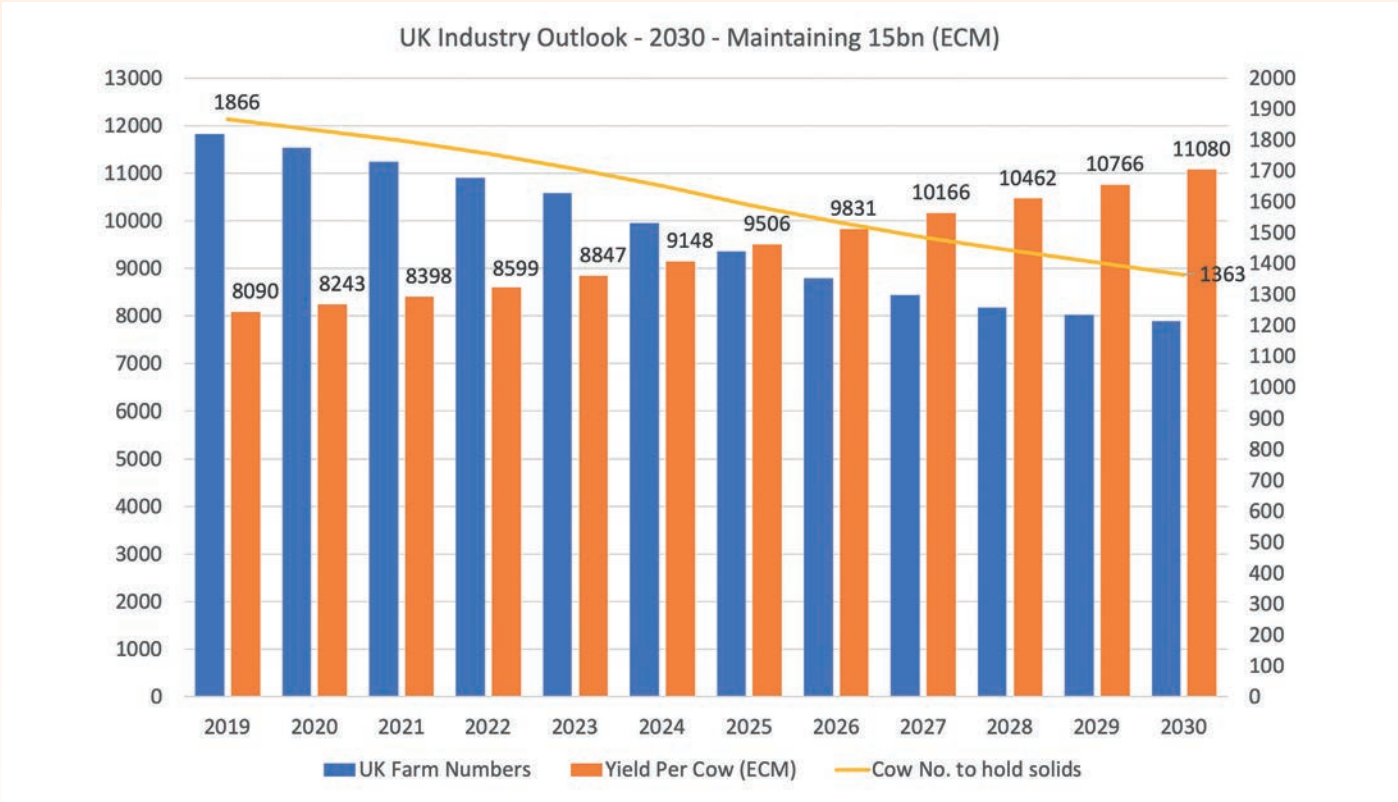
As an industry we have many of the tools and skills already available to help us deliver this reduction. Adopting new technologies and attracting and upskilling new and existing high-quality workers to help deliver this reduction will be crucial. Sequestration has huge potential for UK agriculture but is not included in our figures because the system for measuring it has not yet been clearly defined.



Increasing Yield

Increasing yield per animal and reducing the number of livestock will be a cornerstone to achieving this reduction. Our model looks at increasing the average yield per cow from 8,090 ECM litres in 2020 to 11,080 ECM litres by 2030 (3.5% compound growth of volume and solids over the period), but we are expecting improved genetics, management and feed efficiency to increase yield per cow across all systems.

> Energy corrected milk (ECM) With milk constituents the basis for most milk payments in the UK ECM allows fair efficiency comparisons to be made between different breeds by standardising litreage.



This increase will remove over 500,000 animals from dairy production in the UK (and remove a similar number of calves from the industry). This will allow, in some instances, land to be available to offer the public for environmental options, with a payment being made to the farmer for such land. In addition, the herd reduction will contribute to global cooling as cow numbers fall and methane emissions are reduced.

Table 1. UK Industry Outlook – 2030 Maintaining 15 billion litres

Year	2020	2030 (forecast)
Herds	11,534	7,890
Cows (million)	1.87	1.36
Milk yield (litres/cow)	8,090	11,080
Herd size	158	172
UK output (billion litres)	14.8	14.8
UK Solids Output (M Tonnes)	1.1	1.1

The market

Of course the ability of any dairy farmer in the UK to drive real productivity change on their farm is dependent on the market situation, and the consequent milk price returns available over the next ten years.

We are entering interesting times for world dairy markets. Some key market trends are evident. All of the long-term global trends suggest dairy consumption will continue to increase, with the most growth coming from emerging markets. Established markets may see small declines. What will this mean? Although the UK is a good place to produce milk from a climate and geographical point of view, like most major milk-producing areas, we will come under increased environmental and societal pressure. This will impact dairy production and may impact domestic dairy consumption. It is likely to increase the cost of production as environmental costs become "internalised". Our expectation is that this could result in reduced milk production overall or, at best, stable production. With all the major exporting areas of the world affected by environmental constraints we could see increasing world prices and opportunities for export. This will require a change in approach in the dairy processing sector in the UK. Traditionally, this sector has been focused on meeting domestic demand for high value, often short shelf life products. In future, the processing sector may need to meet the requirements of very different global commodity markets to thrive.

A number of scenarios could play out. If the processing sector does not invest and innovate to seize international opportunities to access growth markets, we anticipate price pressure. If production decreases due to environmental pressure, this could result in relatively balanced markets and price equilibrium. On the other hand, if the processing sector is able to invest and take advantage of the environmental credentials our industry will have and leverage this strong UK provenance on growing global markets, demand could remain strong. Under these circumstances, with production likely to diminish as the industry adapts to tighter environmental requirements, the domestic milk price outlook could be strong.

> There is no denying the ability to continue producing milk in the UK will require meeting high environmental conditions ..

It is, as ever, impossible to predict markets for 10 years. There can be no doubt, however, market dynamics, both globally and domestically, will impact on the pace of change in terms of environmental improvements in UK dairy and on the future shape of the sector as a result. There is no denying the ability to continue producing milk in the UK will require meeting high environmental conditions and milk contract prices will be dependent on achieving them.

GENETICS: A KEY ENVIRONMENTAL ROLE

Introduction

There is a large role for genetic improvement within the national dairy herd as part of the goal to reduce the environmental impact of the dairy and wider cattle industry. In the last 10 years, with the introduction of genomic testing of bulls and heifers we have seen an acceleration of genetic gain.

Key points

- Integrated farm-wide breeding strategies, including genomic testing, are vital in ensuring fast genetic gains
- Breeding strategies should encompass a range of traits, including production, health, longevity and efficiency
- Rumen methane production could be manipulated by genetic selection, helping to reduce dairy's carbon footprint
- Advances in sexing technology will improve conception rates and purity, leading to faster generational interval and better dairy-beef integration

Genomic testing and its use in breeding programmes will enable a multifaceted approach to breeding cattle. This includes milk solid production, health traits and other desirable characteristics all combining into a customised index. Genomic testing of heifers has come down in price and will continue to do so as adoption becomes wider. In a 2018 DEFRA survey, only 20% of farmers genomic-tested heifers.

The increased accuracy of information allows higher selection pressure to be applied to the herd, thus increasing the rate of genetic gain above standard practices. Genomic testing has already significantly reduced the generational interval of bulls compared to traditional progeny testing.

Feed efficiency is the holy grail for other livestock production systems. In the meat industry it is focused on the dilution of maintenance by breeding bigger animals faster. In dairy it is more complex as we are trying to hold or even reduce animal size, but increase milk solids production whilst reducing feed intake.

The heritability of feed efficiency looks promising which will allow us to make significant improvements quickly.

Further advancements in research and technology will allow us to make breeding decisions which not only will reduce feed use and improve output and profitability, but will rapidly drive down carbon footprints.

There is a huge degree of variation in efficiency within a herd. This variation, accurately identified, represents differences that we can select for.

As research continues to be funded and farm data systems become more accurate and integrated, new traits will be identified and potentially bred for in the future. All management characteristics rely on the quality of information which historically has been collected through milk recording.

Sexed Semen

Advancements in sexing technology and its use in breeding programmes will have a two-fold positive environmental effect. Firstly, it will enable the production of a more valuable heifer from the best cows in the herd, reducing the number of dairy bull calves created.

Secondly, it will increase the value of a beef calf produced by allowing for a terminal cross type animal, as seen in other livestock sectors, that better meets the demands of consumers and is more efficient to produce. A key opportunity is to integrate this traceable and more efficient beef calf within a specific beef supply chain, allowing value to be captured and emissions to be monitored.

> ...genetic management of dairy cattle has a huge potential to reduce the environmental impact of the dairy industry...

Genetics and methane emissions

There is some evidence genes can influence the gut microbiome of cattle and, with this, can affect methane emissions. It is anticipated this work will advance and at a quicker rate than previously seen due to genomic testing advancements.

Genetics and health traits

With the focus on improving health traits through genomic selection we **can** breed cows that are fitter, healthier and longer living. Reduced culling rates, selling of lower genetic quality heifers and the corresponding reduction in youngstock numbers will improve farm profitability while reducing carbon emissions. Genetic gains are permanent and additive, and therefore make sound investments. They are also slow to implement, so the impetus is on farmers and advisors to make the most of new technologies as soon as they come to market in order to extract maximum value.

Overall genetic management of dairy cattle has a huge potential to reduce the environmental impact of the dairy industry, through selective breeding programmes allowing efficiency and productivity to improve and methane emissions to reduce.

Genetics and fertility

Fertility of dairy cattle is a limiting factor for production and there has been a large decrease in the fertility of dairy cattle since the 1960s. This has largely been due to a focus on production traits rather than breeding efficiency leading to a reduction in overall herd fertility, reduction in conception rates, reduction in oestrus times, days open and services per conception increased. However, over the last 10 years this has changed as it has been brought back into breeding programmes very successfully, even though the heritability is very low many highly fertile lines also possess excellent milk production traits. Improvements in conception rate and oestrus detection can be driven through implementation of technology, better data analysis and farm management. If fertility levels were improved back to the levels seen in 1995, but with current production figures, we could see a drop in total methane levels by as much as 10%.

NITROGEN BALANCE ON DAIRY FARMS

Introduction

Improving use of nitrogen equates to at least a 10% reduction in GHG emissions in our model. Nitrous oxide plays an increasingly important part in GHG emissions and calculations. Improved nitrogen fertiliser, slurry and manure management, both inside and outside buildings, and improved cow performance, will play an important role in UK dairy farmers hitting the 30% GHG reduction aim.

Key Points

- Better management and use of nitrogen will help reduce GHG emissions from UK farms.
- A farm's nitrogen balance measures the nitrogen brought onto the farm (feeds, fertiliser, stock, manures) compared to the nitrogen leaving the farm (milk, forages, stock, manures).
- This effectively represents nitrogen unaccounted for, or most likely, lost to the environment (either in the air or into the ground/water).
- Improving output per cow and producing more milk from the farm's own resources will help address nitrogen balance.
- Balancing nitrogen will help reduce a farm's GHG emissions.
- Farmers need a holistic approach to N management. For example, getting the pH right can increase N uptake efficiency by 30%.

Alongside improvements in management practices and genetics, one of the major aspects of increased productivity over the past decades has been the almost magical qualities of increasing nitrogen supply to both plants and animals. Unfortunately, the supply of additional nitrogen past a certain point gives diminishing returns (reduced utilisation efficiency) and increases, considerably, its loss into the environment.

Looking at the reduction in fertiliser use over the past few decades, it seems clear there has been a reaction to this, presumably aided by the tightening of farm margins over that period.

The currency of a farm nutrient balance, especially nitrogen which can be so damaging to health and environment, has not yet developed in the UK, although in other parts of the world this is beginning to feature in legislation. The essence of a farm nitrogen balance is that it measures the nitrogen brought onto the farm in various forms (feeds, fertiliser, stock, manures) and compares this to the nitrogen leaving the farm (milk, forages, stock, manures). Bearing in mind the muck produced by dairy stock is applied to the land and is part of the crop growing equation, the balance between the inputs and outputs of nitrogen for a farm effectively represents nitrogen unaccounted for, or most likely, lost to the environment (either the air or into the ground/water).

The efficiency of feed protein (N) use across dairy farms will only be around 25% and the higher the feeding level of protein to a cow, the lower this figure. The remainder is lost to the air or into the slurry lagoon, from which further losses to air and/or water/ground are likely. It is understood manure storage and application accounts for 37% of ammonia (NH_3) losses from agriculture. This figure has the potential to come down considerably and, if implemented, would result in a reduced need for purchased fertiliser. This in turn would improve the nitrogen balance of a dairy farm.

The table on page 11 shows a number of scenarios for a simple dairy farm (Baseline) and demonstrates the concept of nitrogen balance. The key messages from these calculations are:

- Significant improvements can be made in the nitrogen balance per unit of product (litres of milk or kg of milk solids) by improving the output per cow and producing more milk from the farm's own resources.
- Where the above can be achieved and additional gains can be made on manure management leading to reduced nitrogen inputs and improved feeding efficiency, very significant improvements in the nitrogen balance can be anticipated. Scenario 3 shows that genetic gains over the next decade, added to improved forage, feeding and manure management, could very easily result in a 40% reduction in nitrogen surplus per farm and 52% reduction in nitrogen surplus per kg of milk solids.

These improvements are well within the grasp of the UK dairy industry and will be important milestones in retaining its social licence to continue in business. While there may be grants aiding measures to improve nitrogen efficiency on dairy farms, it will be legislation that brings the pressure for the most change at farm level. That said, where dairy farmers have a plan to increase productivity, the cost of nitrogen compliance should be available through improved business margins, plus the savings on fertiliser and feed costs (protein) not accounted for in the Margin over Purchased Feeds (MOPF) shown below.

> These improvements are well within the grasp of the UK dairy industry

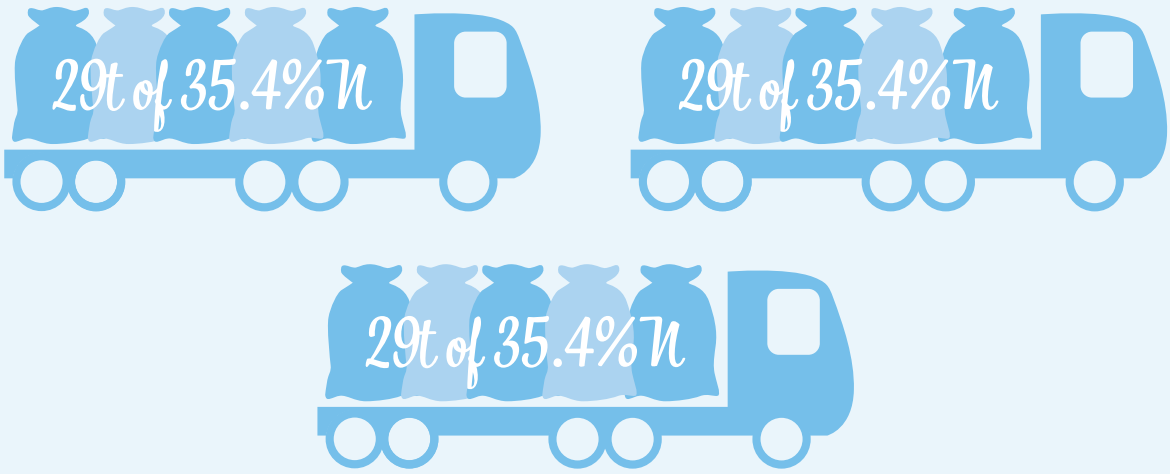
Notes:

1. Farm size = 109 hectares; flying herd

2. It has been assumed NVZ rules have been applied to each scenario regarding stocking rates (i.e. 170kgN/ha limits) and assumed N outputs at different yield levels. The balancer used here has been the export of an appropriate amount of manure (at 170kg/ha) to a neighbouring or associated farm business with spare NVZ capacity.

Scenario	1	2	3
	Baseline	**More milk + protein**	**More milk + protein, less fertiliser, lower %CP, higher fat**
Cows	230	230	230
Yield (litres)	8,750	9,750	9,750
Fat	4.0%	4.2%	4.5%
Protein	3.26%	3.60%	3.60%
Milk output (litres)	2,012,500	2,242,500	2,242,500
Milk solids output (kg)	150,491	180,162	187,092
Milk price (Muller std)	28p	28.5p	29.25p
MOPF for herd	£439,226	£517,107	£534,431
Milk from forage	2,612	3,612	3,612
Feed rate per litre	0.32	0.29	0.29
Purchased N on grassland	300kg/ha	300kg/ha	250kg/ha
Protein in bought feed	17.7%	17.7%	16.0%
IMPORTS of N (kg)			
Feeds	18,179	18,179	16,413
Fertiliser	25,527	25,527	21,877
Livestock	957	957	957
N-Fixation	0	0	0
Imported manures	0	0	0
	44,663	**44,663**	**39,247**
EXPORTS of N (kg)			
Livestock	1328	1328	1328
Milk	10812	13304	13304
Exported manures	4723	7943	7943
(NVZ compliance)			
	16,863	**22,575**	**22,575**
Total Nitrogen surplus			
Kg of N	**27,800**	**22,088**	**16,672**
Kg/ha	**255**	**203**	**153**
% Reduction in farm surplus		21%	40%
Nitrogen surpluses per unit of output			
g of N/kg of milk	13.8	9.8	7.4
% Reduction		29%	46%
g of N/kg milk solids	184.7	122.6	89.1
% Reduction		34%	52%

What does this saving in nitrogen look like?



total saving of

30,000kg

nitrogen

Enablers

UK dairy producers are innovators, having learnt to live with uncertainty and challenge as a result of a volatile milk market over the past decade. They have shown themselves to be resilient, open to new ideas and adaptable, both of which will be crucial as they face the challenge of reducing GHG emissions.

A significant reduction can be achieved through science, adoption of new technology and a focus on excellent technical performance, using the latest innovations and developments.

> UK dairy producers are innovators

Technology

New technologies have already changed the way we farm. From satellite field mapping for efficient fertiliser application, to in-line progesterone testing and remote sensing for health and fertility issues, new technology has helped improve cow health and reduce farm inputs. Fertile, healthy cows are more efficient cows, producing more milk with fewer inputs. A 30 day reduction in days in milk equals a two litres increase of average daily production per cow. They have longevity, reducing the need for replacements, again reducing their carbon footprint.

Block chain technology, where data from a number of sources is linked together, stored in many locations and accessible to all (delivering transparency and security) will revolutionise the way dairy farmers and the industry receive and use information. It will mean more high quality, timely information on which to base decisions. This again will lead to more efficient dairy cows and dairy businesses.

The pace of new technology shows no signs of slowing up and will help the dairy industry find the solutions to our environmental challenge.

> We are going to ask even more from our people as we address this challenge.

People

None of the new technologies mentioned above, or any of the solutions discussed in this report, will have an effect without a highly skilled workforce putting them in place. We are going to ask even more from our people as we address this challenge.

The dairy industry is beginning to wake up to the value of a motivated, efficient workforce but continued development in recruiting, retaining and training the right employees, as well as people management skills, will be crucial in our ability to reduce our GHG emissions.

Conclusion

Brexit may well mean British consumers have access to food that is not produced under the same environmental controls as in the UK. However, our 'license to farm' in the UK is reliant on our willingness to change the way we farm and reduce our GHG emissions. UK dairy farmers have an opportunity to build on their success through further and faster reductions in the GHG emission from the food they produce.

There will be a role to play in informing consumers both at home and abroad of our environmental criteria and why there are attached costs.

We have the ability, the requirement from our consumers, and the desire as an industry to farm in a more environmentally-friendly way. As we have with animal welfare standards, the UK dairy industry can and will lead the way in environmental policy. While the political situation remains uncertain, our goal, and that of consumers, remains the same: to protect and enhance the environment while maintaining adequate high-quality food supply.

Get this right and we have the opportunity to use our sustainability, provenance and positive reputation to grow our marketplace both at home and abroad. Improving our environmental credentials will only add to our ability to sell UK dairy products across the globe. With the next generation of farmers, we see a positive future for UK dairy to produce great nutritious natural food and lead the world in producing more from less.

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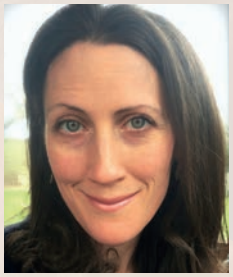
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