

HDRF Conference 2022:
Feeding the Next Generation Dairy Cow



Hannah Dairy Research
Foundation



Journal of Dairy
Research

Edinburgh, November 21st and 22nd 2022

21 November 2022

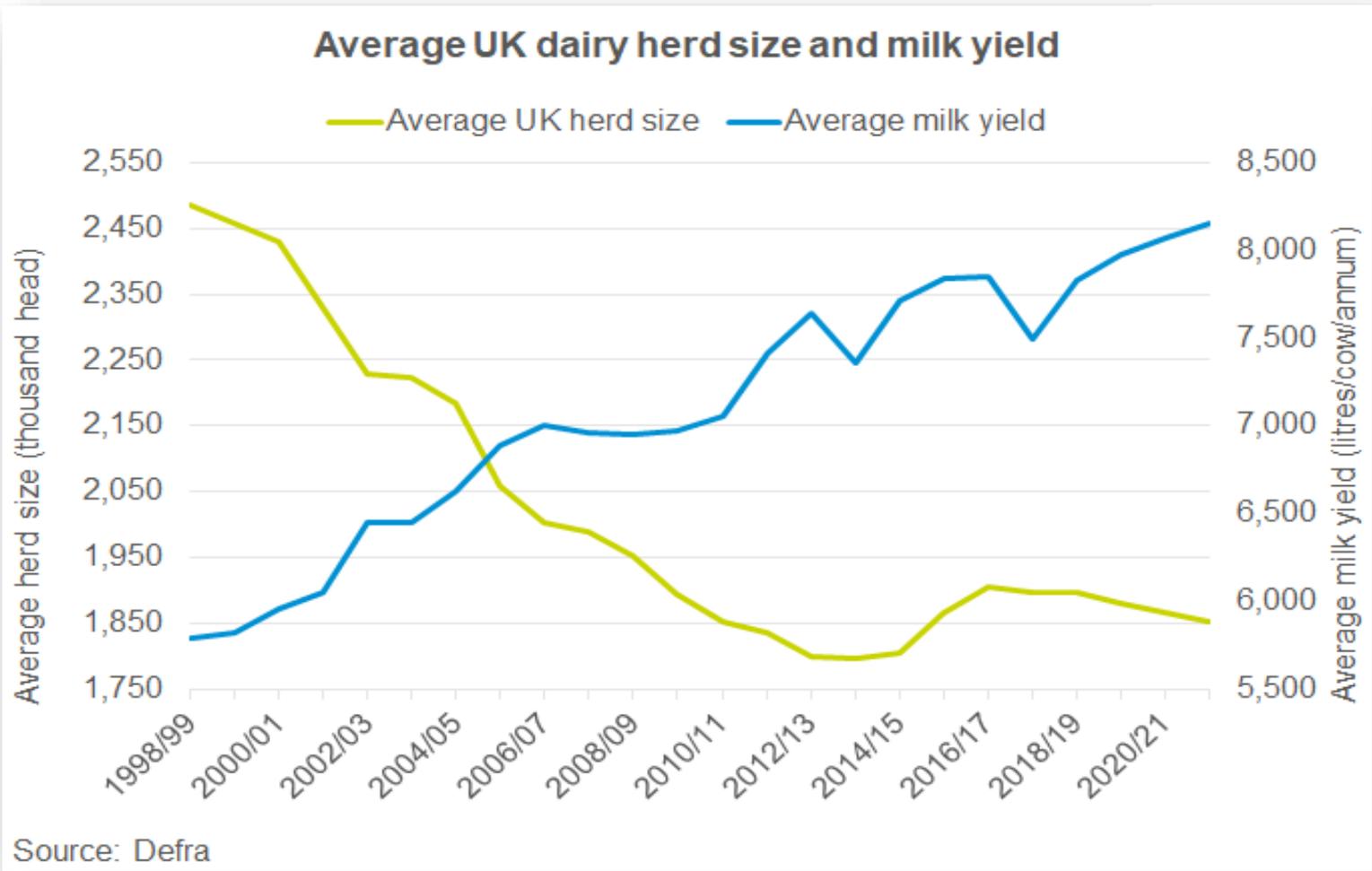
The Next Generation dairy cow: What does the industry want from her...

Marco Winters

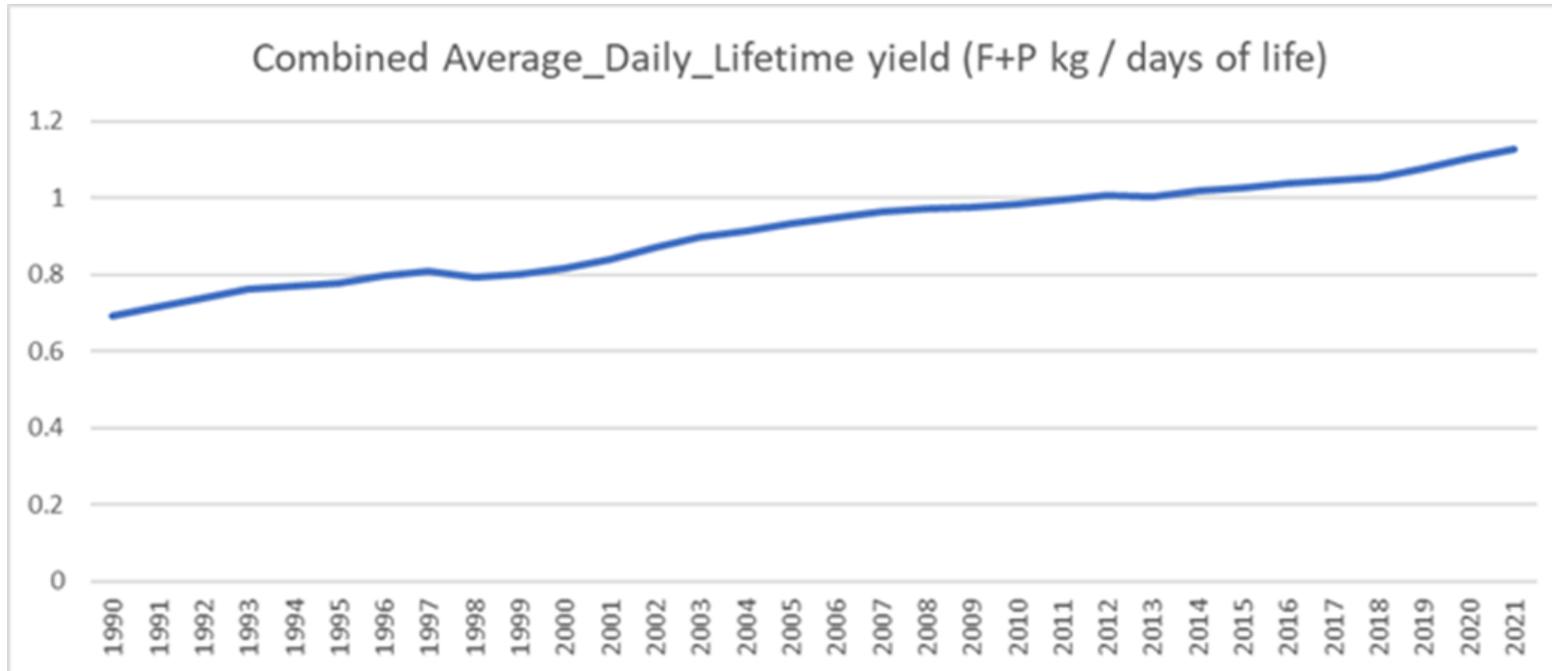
Head of Animal Genetics



Genetics has had a big impact on our industry



Improving industry efficiency - measured by Daily Lifetime Yield



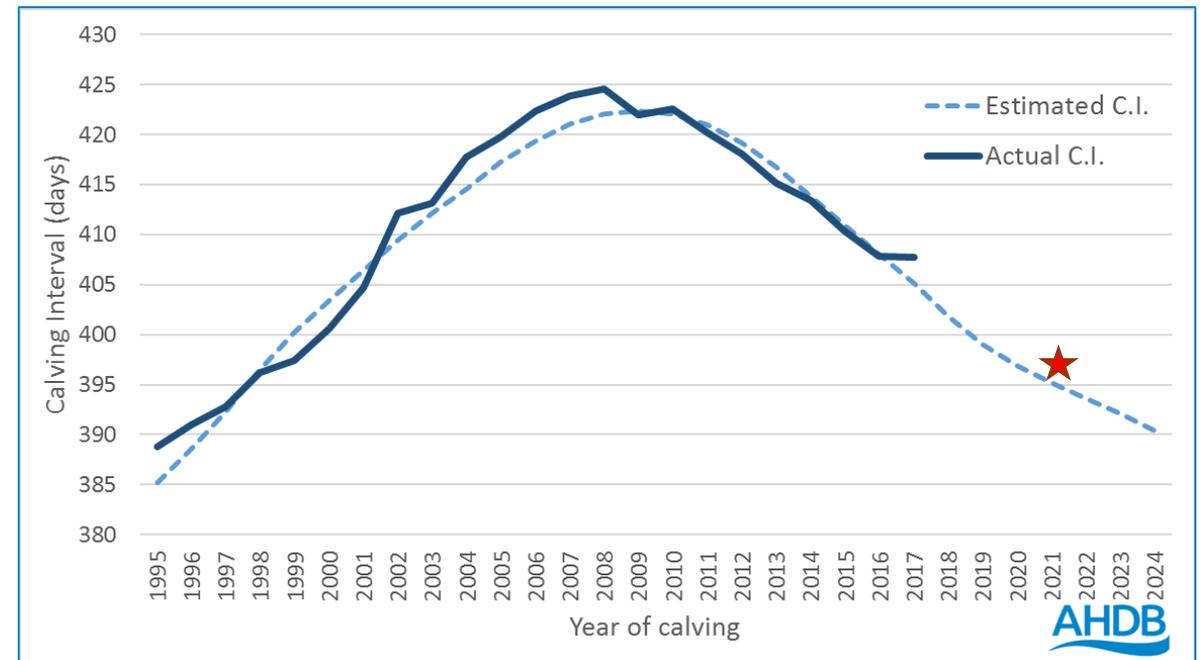
Source: Milk recording data used in AHDB's Dec'21 genetic evaluation release

What next does the industry want from our cows?

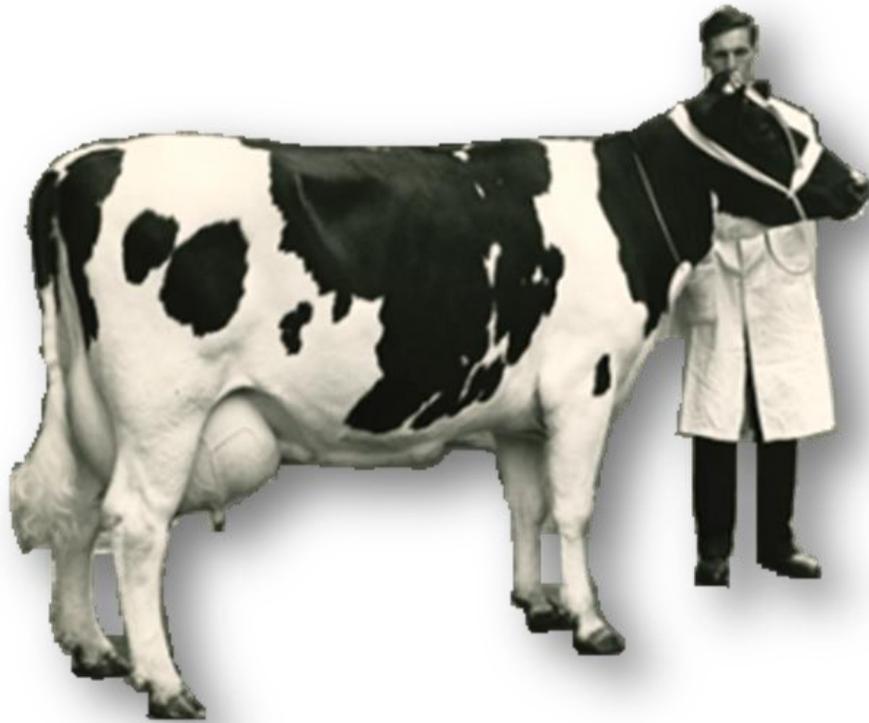
Impact of genetics

- Impact of genetics on **production** and **type** no longer questioned
- Health traits were initially slower on uptake (but benefit now well accepted. E.g. **SCC's**)
- **Fertility Index** impact now also well understood (available since 2005)
 - National Calving interval follows genetic changes as a result of better bull selection
 - Around 1/3 of improvements due to genetics

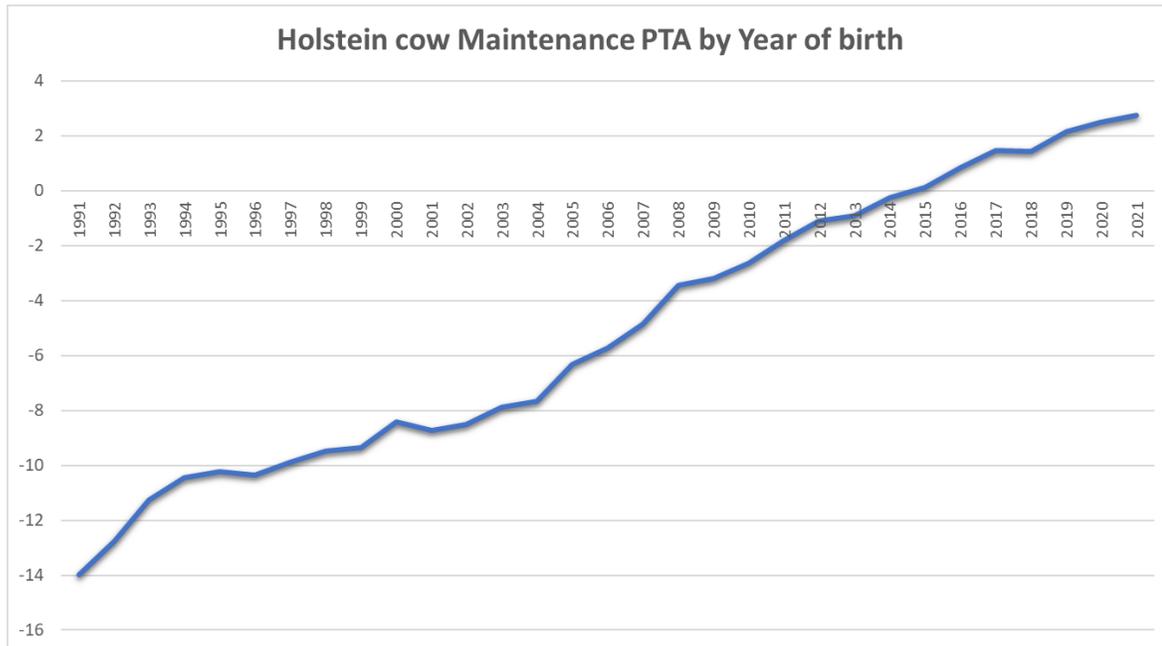
Genetics can provide significant and permanent improvements to many industry challenges



Breeding has significantly changed today's cow



Unfavourable trend in Maintenance



- Bigger cows means we now have an equivalent of 60,000 tonnes of cow LW to feed each day in the UK !
 - Which is ~90,000 mature HOL cows
- For an average herd of 200 cows
 - Roughly 10 extra cows to feed ...each day

World Population hits 8 billion, creating many challenges

The United Nations says the world's population is reaching the 8 billion mark on Tuesday

Dan Ikpoyi, Chinedu Asadu • 2 days ago



yahoo/finance | Yahoo Finance UK

Inflation hits 41-year high of 11.1% on the back of energy and food price hikes



Pedro Goncalves • Finance Reporter, Yahoo Finance UK

Wed, 16 November 2022 at 8:50 am · 5-min read

World Population hits 8 billion, creating many challenges

The United Nations says the world's population is expected to reach 8 billion on Tuesday

Dan Ikponmaba
Chemicals [+ Add to myFT](#)

Russia supply shock forces rethink for chemicals and fertiliser groups

Shutdowns, shortages and surging prices
system



Science & Environment

Farming labour shortage could mean price rises, MPs warn

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It's been a year since the Global Methane Pledge launched. See how the world is pacing.
Emma Rubin - Nov 2
of energy and
food price hikes



Pedro Goncalves · Finance Reporter, Yahoo Finance UK

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Shutdowns, shortages and a new system

Limiting Antibiotic Use in Dairy Cows Attractive to Milk Drinkers

News Published: November 8, 2022 | [Original story from Cornell University.](#)

18 Images Big Dairy Doesn't Want You to See (but PETA Will Show You)

Inflation hit a 41-year high of 11.1% on the back of energy and food prices. It's been a year since the Global Methane Pledge launched. See how the world is pacing.



Emma Rubin - Nov 2

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What does society want from her?

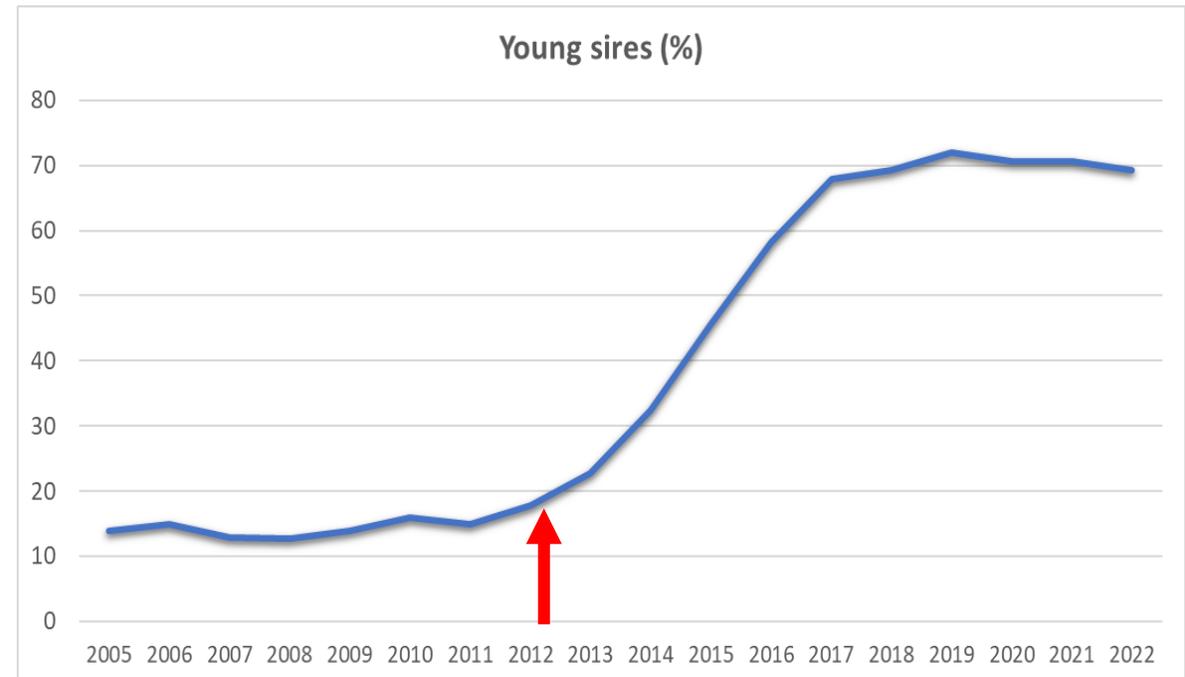
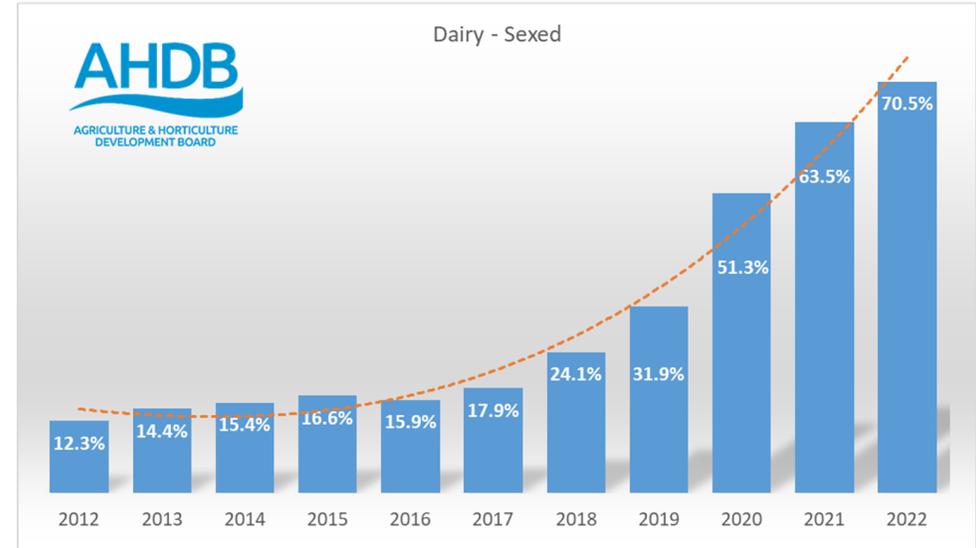
- ✓ Increased supply to satisfy demand
- ✓ Cheaper product to keep (or make) it affordable
- ✓ Healthy animals to minimise use of medicine and promote well-being
- ✓ Animal Well-being protected
- ✓ 'Greener' to support sustainability agenda (..and make consumption justifiable)

• What does this mean for the future dairy cow?

- 'Produce more from less'
- In a way that is acceptable to society ('Licence to produce')
- And 'easy care' cows

UK dairy breeding in a snapshot

- Use of sexed dairy 
 - ✓ now >70% of all dairy inseminations
- Use of beef semen 
 - ✓ Close to 50% of all inseminations
- Use of genomic young sires 
 - ✓ at ~70% of all dairy inseminations
 - (doubling genetic progress !)



Seeing the industry through different lenses



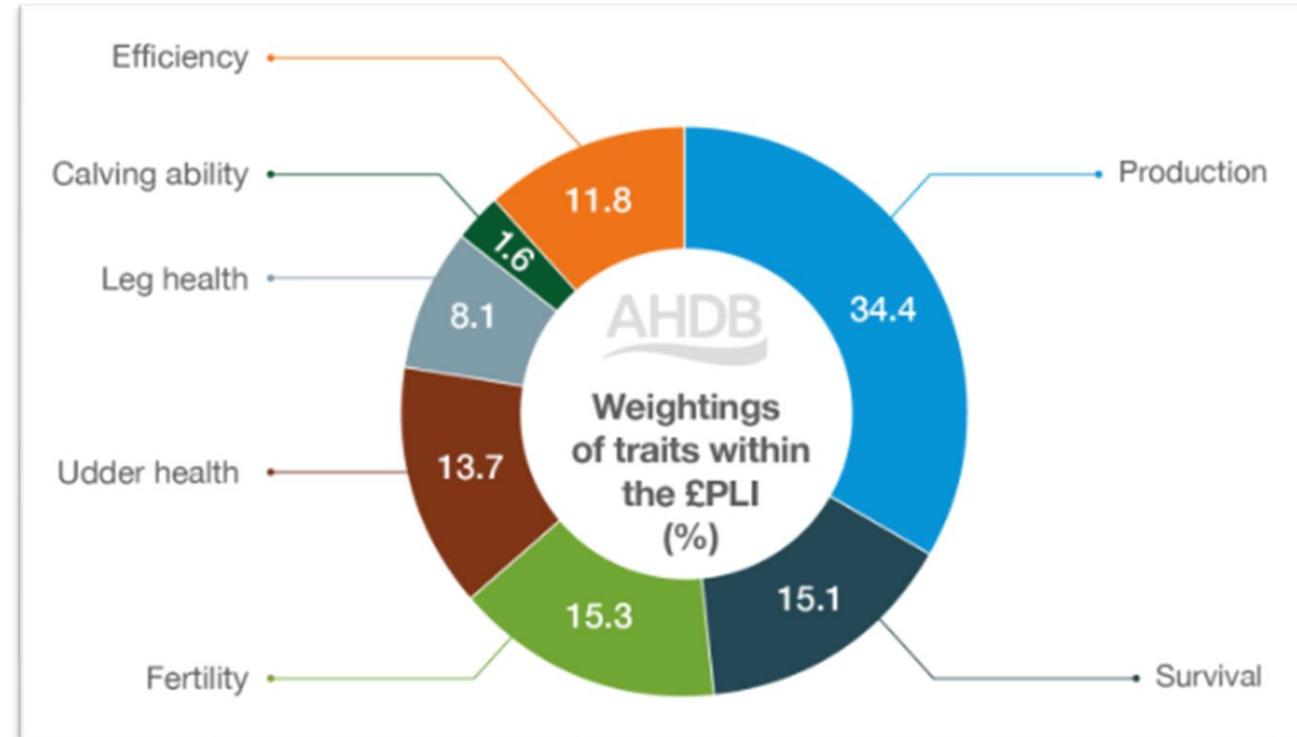
Dairy industry is polarising.... having different needs

Breeding 'Wish list'

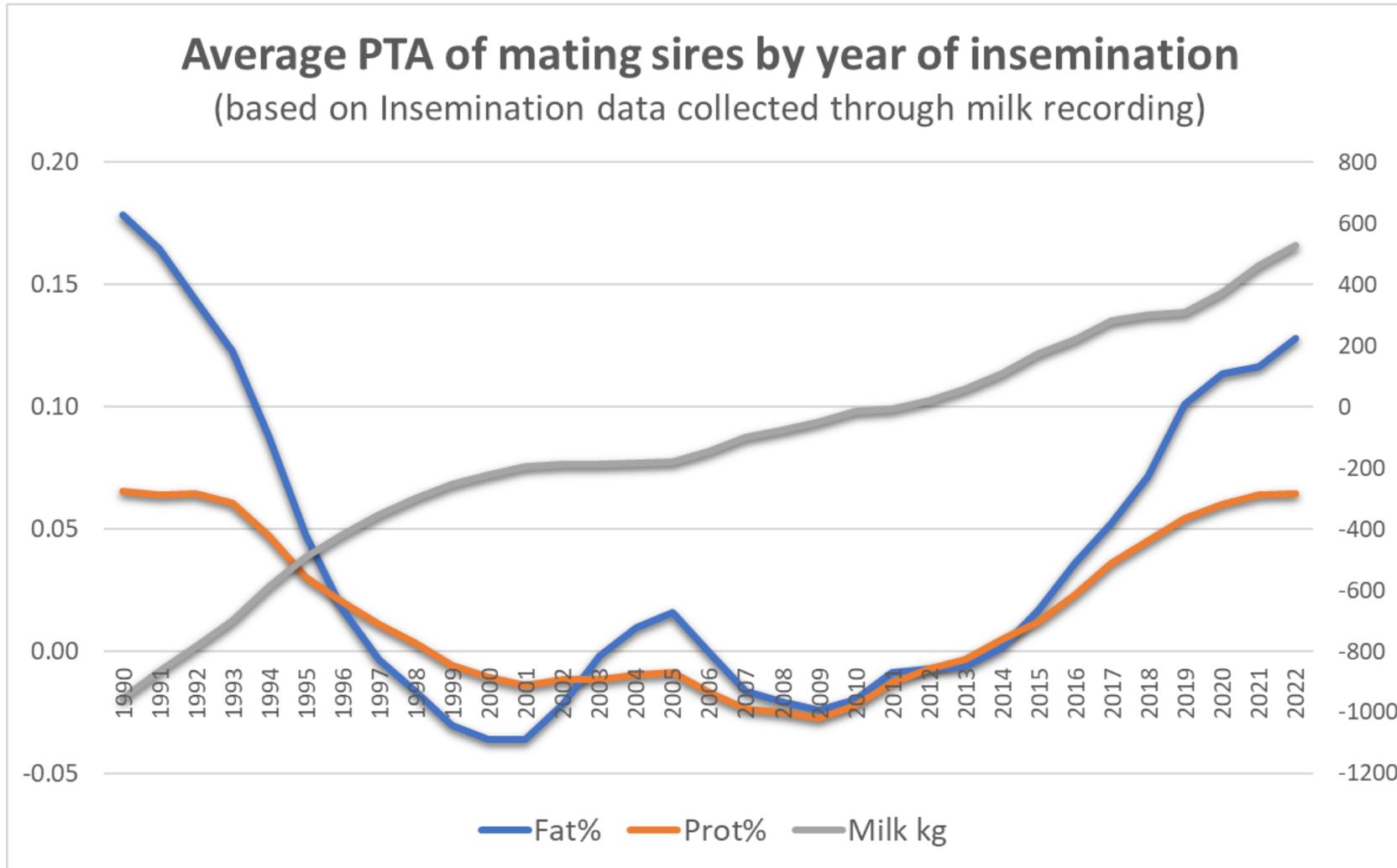


We now have many traits to help shape the future

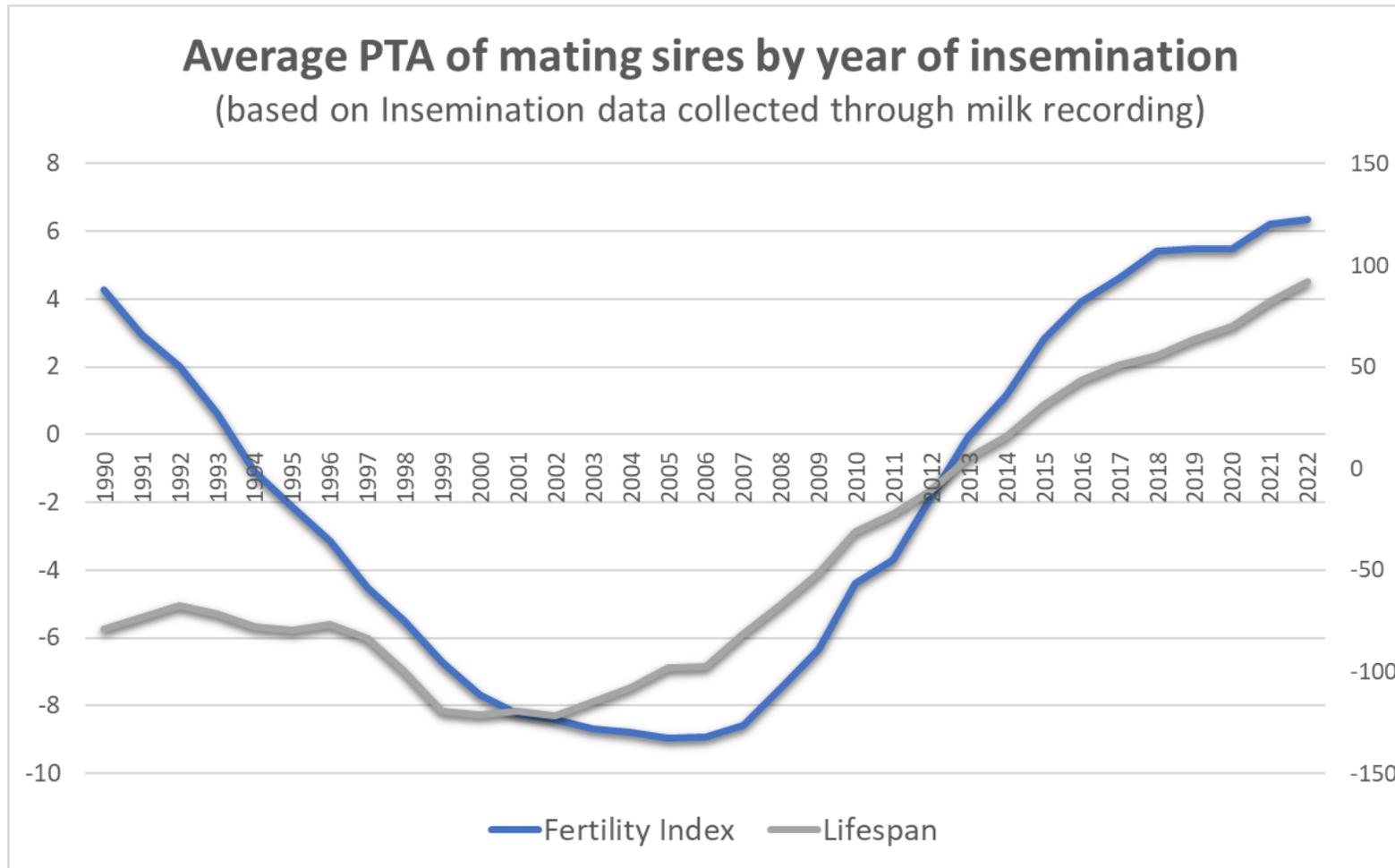
- To assist, we provide profit ranking indexes
 - Match appropriate genetics to various UK systems
- **£PLI** – Profitable Lifetime Index
 - All-year-round; *Within* breed ranking
- **£SCI** – Spring Calving Index
 - Spring block; *Across* breed ranking
- **£ACI** – Autumn Calving Index
 - Autumn block; *Across* breed ranking



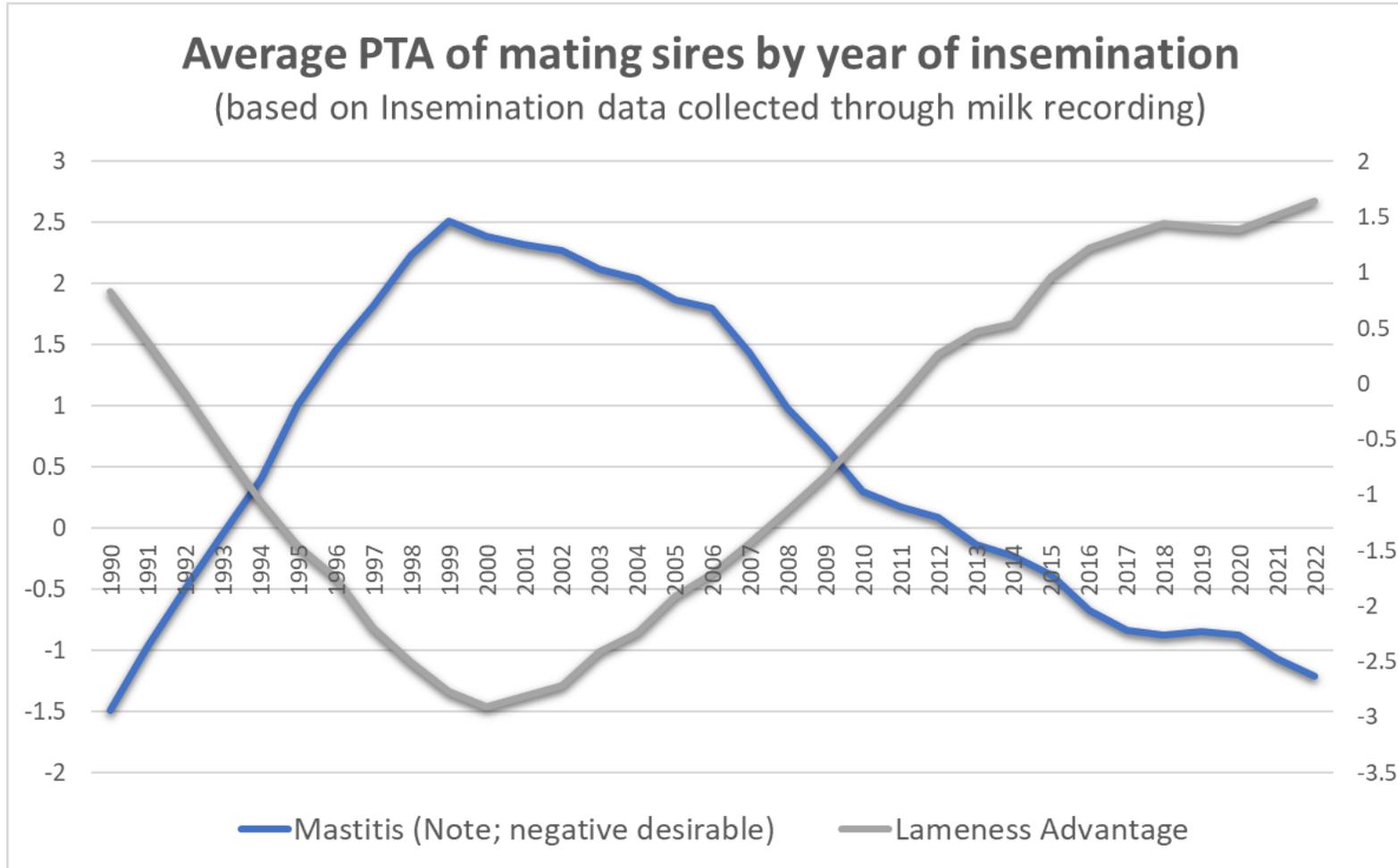
What kind of cow is coming?



What kind of cow is coming?



What kind of cow is coming?



New genetic indexes to fine tune our needs



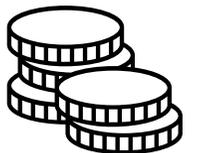
- ✓ Great progress made in Production and Fertility
- ✓ New health traits doing well too → Lameness Advantage, Mastitis, Calf Survival
 - Further promote a health focus

➤ Feed Efficiency is our next targeted

- Maintenance index (available for all breeds)
- Feed Advantage (HOL); *Saving Feed, while maintaining production*

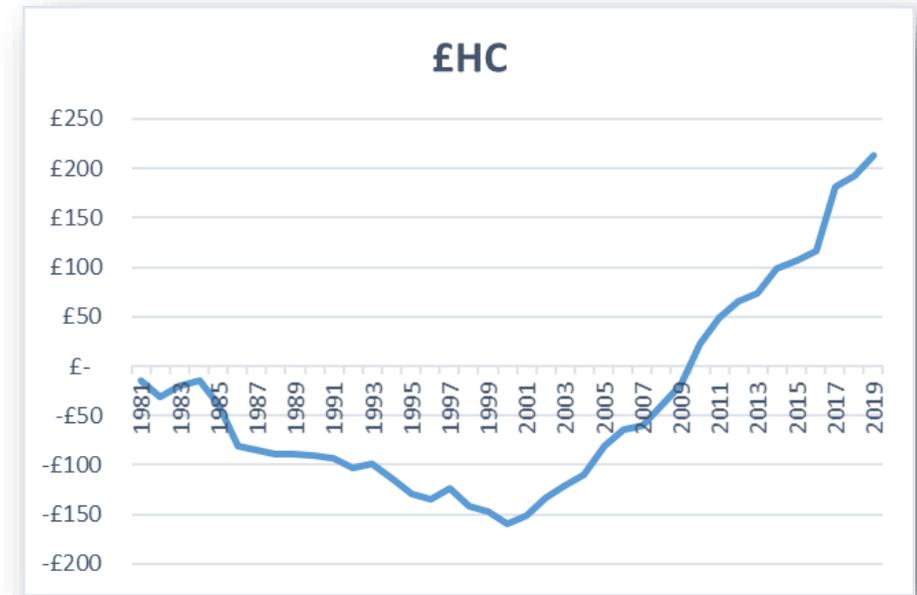
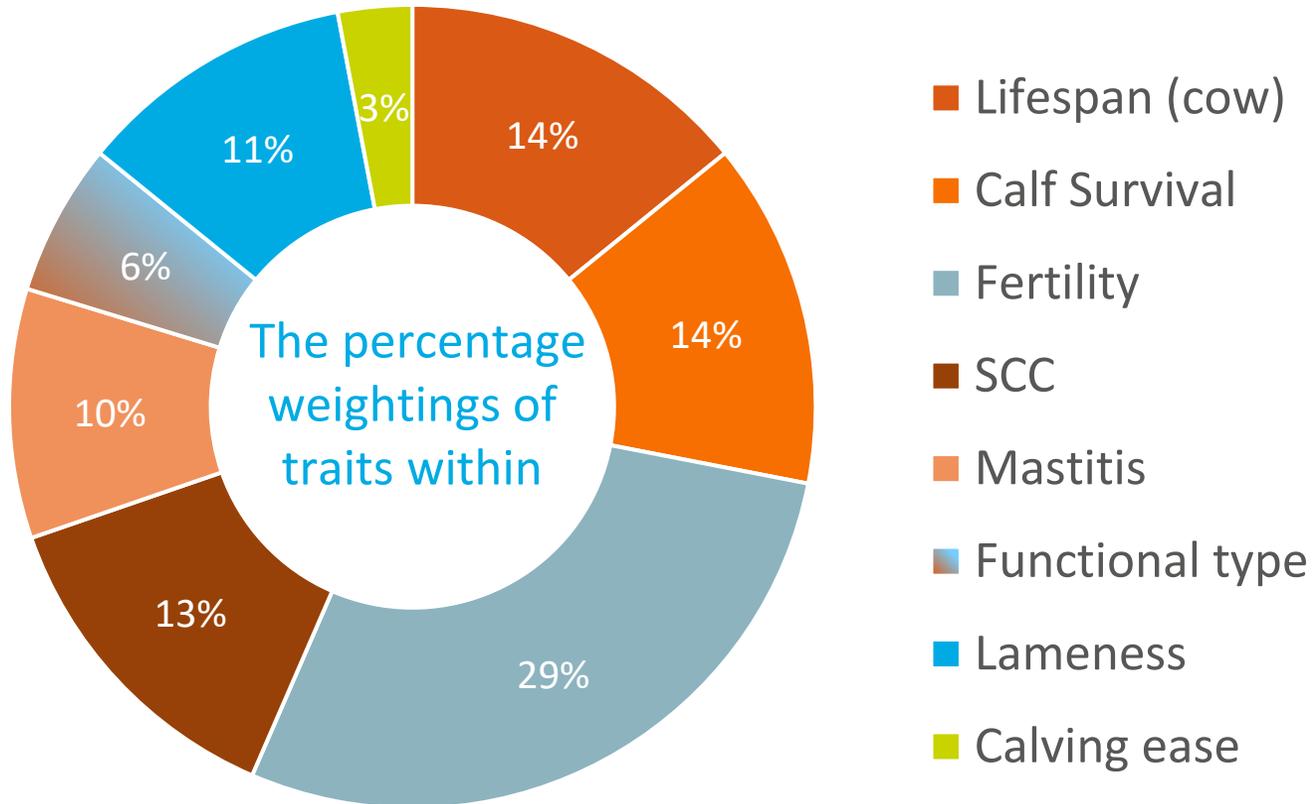


Difference between best and worst bulls ~500 kg Dry Matter per lactation

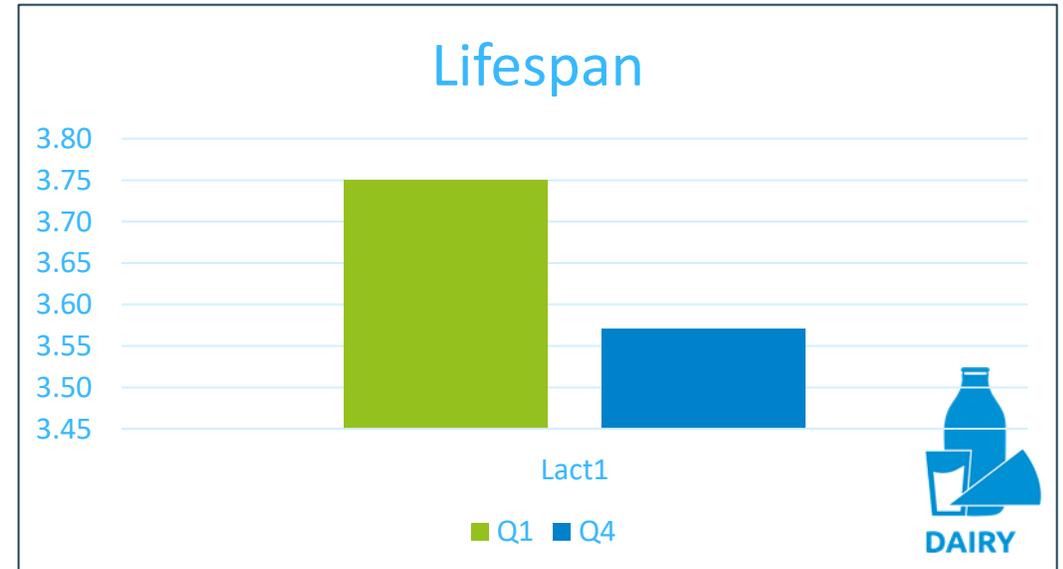
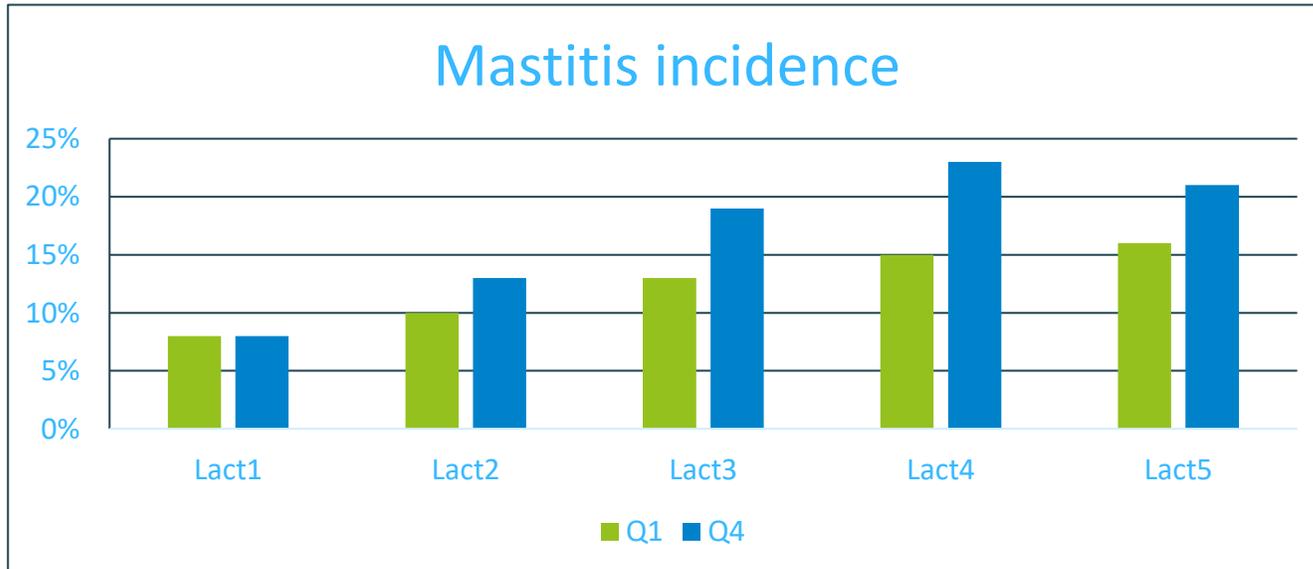
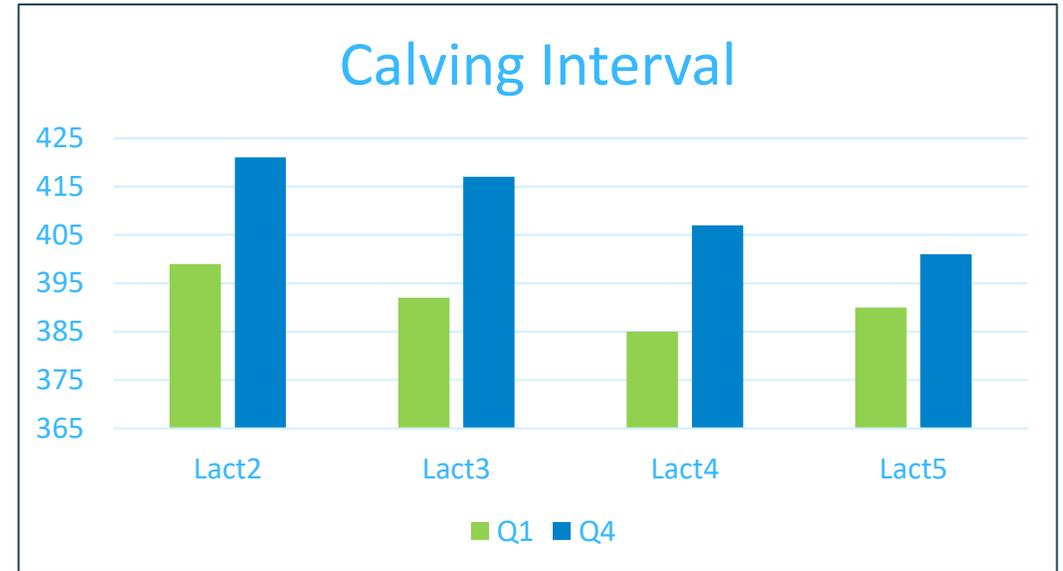
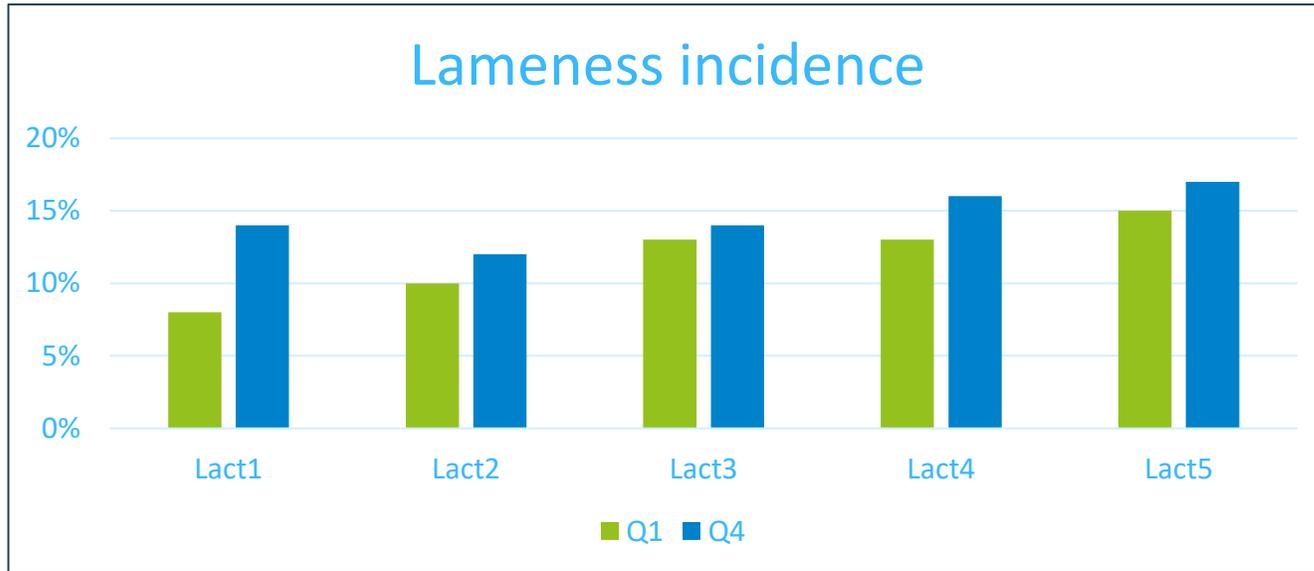


New since 2021; HealthyCow index

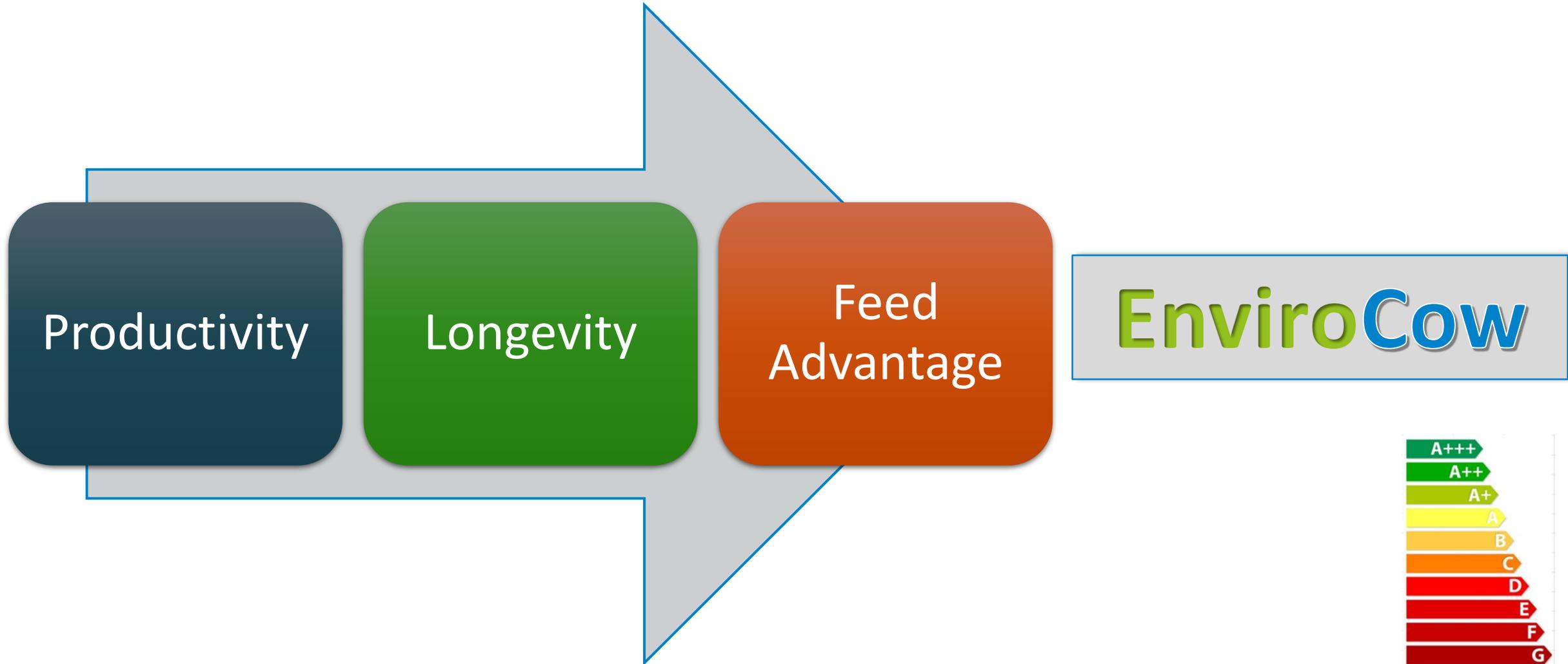
Represents the financial saving each bull is predicted to pass to his daughters through their better health, expressed in £ (£HC)



Progeny performance of Top (Q1) and bottom (Q4) £HC bulls



Future needs – Produce more from less



EnviroCow

- Genetic index to reduce CO₂ equivalent per kg product produced
 - Using Methane production as our target GHG
- Many of our indexes already contribute to improved efficiencies (!)
 - E.g. Yield per cow, improve health, improve lifespan, reduce feed
- We calculate Methane Intensity = Gross Emission per KG product (Kg Protein equivalent)
 - For every trait we can calculate additional contribution to both Emission and Product ('*Trait Intensity*')
- Using the Mature cows output as;
 - Milk, Fat, Protein (per lactation)
 - Meat (cull cow – once in her lifetime)



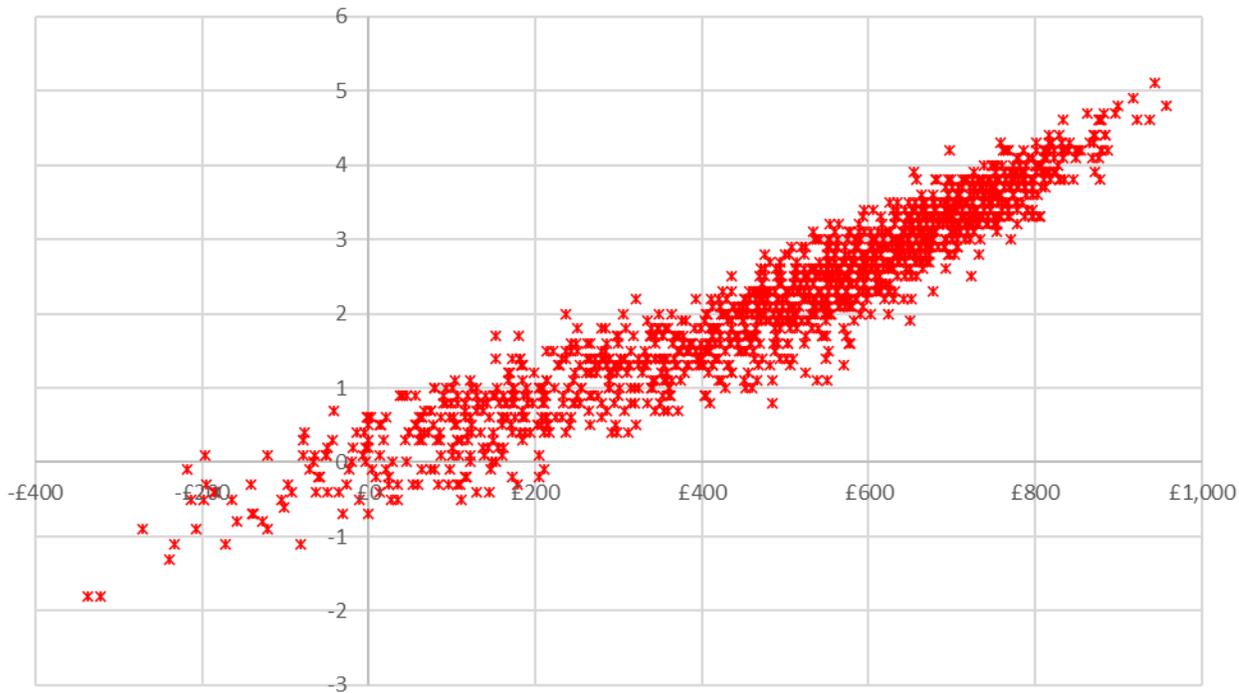
J. Dairy Sci. 102:11153–11168
<https://doi.org/10.3168/jds.2019-16943>
 © American Dairy Science Association®, 2019.

Prediction of effects of dairy selection indexes on methane emissions

X. Zhang,* P. R. Amer, G. M. Jenkins, J. A. Sise, B. Santos, and C. Quinton
 AbacusBio Limited, Dunedin 9058, New Zealand

Active Holstein bulls

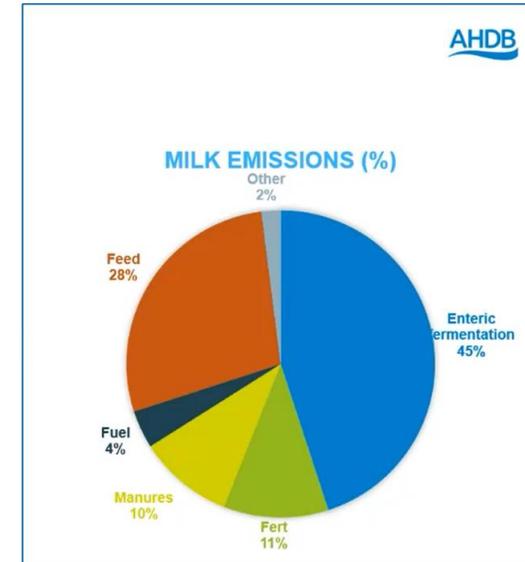
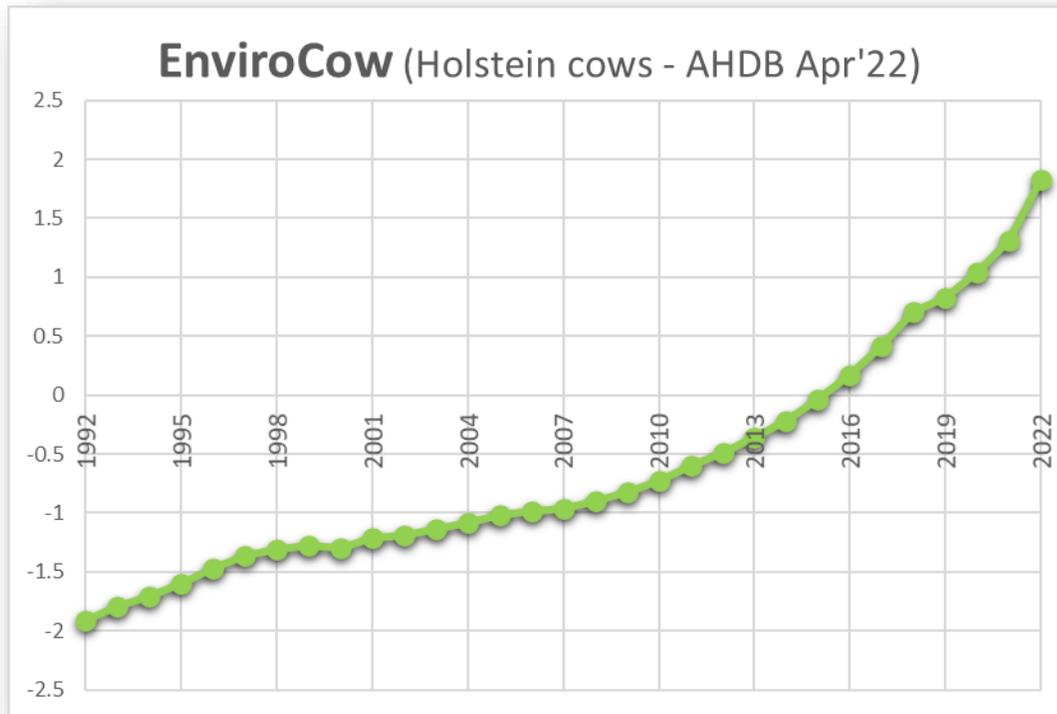
£PLI vs EnviroCow



EnviroCow	Count	Grade
6	1	A+++
5	60	A++
4	343	A+
3	403	A
2	305	B
1	211	C
0	67	D
-1	6	E
-2	0	F
-3	0	F
-4	0	F
-5	0	G

EnviroCow index

- Direct + indirect effects due to genetic improvement reduces CO₂e/kg FPCM by just over 1% each year
- Genetics is estimated to contribute a 20% reduction by 2040



How to handle inbreeding

- Growing evidence that not all inbreeding is equal
 - Recent vs Historic
- Purging removes unwanted effects
- Historic inbreeding might actually be beneficial
- Recent work by Dan Pitt (AHDB) is finding similar evidence in UK Holsteins

Evolution Letters   [Open Access](#)

LETTER | [Open Access](#) |  

Mutation load decreases with haplotype age in wild Soay sheep

Martin A. Stoffel , Susan E. Johnston, Jill G. Pilkington, Josephine M. Pemberton

First published: 17 May 2021 | <https://doi.org/10.1002/evl3.229> | Citations: 3

Research Article | [Open Access](#) | [Published: 27 September 2019](#)

Inbreeding depression due to recent and ancient inbreeding in Dutch Holstein–Friesian dairy cattle

[Harmen P. Doekes](#) , [Roel F. Veerkamp](#), [Piter Bijma](#), [Gerben de Jong](#), [Sipke J. Hiemstra](#) & [Jack J. Windig](#)

Genetics Selection Evolution **51**, Article number: 54 (2019) | [Cite this article](#)

Research article | [Open Access](#) | [Published: 01 September 2020](#)

Effect of recent and ancient inbreeding on production and fertility traits in Canadian Holsteins

[Bayode O. Makanjuola](#) , [Christian Maltecca](#), [Filippo Miglior](#), [Flavio S. Schenkel](#) & [Christine F. Baes](#)

BMC Genomics **21**, Article number: 605 (2020) | [Cite this article](#)

Additional issues to consider for the industry...

Press release

Genetic Technology Bill: enabling innovation to boost food security

New legislation will make the UK the best place in the world to invest in agri-food research and innovation.

Cell-Based Milk Could Change the Dairy Industry

By webasiaglobaldata 10 Nov 2022

NUTRACEUTICALS



Summary

- Many challenges facing the industry
- Consumer is further removed from Ag, but has bigger expectations
 - 'Licence to produce' driven by legislation and consumer demand
- Ongoing research needed to further finetune our needs
 - Microbiome?
 - Methane measurements, Nitrogen use efficiency... #PhenotypelsKing
 - Managing genetic resources
 -
- Genetics has a proven track record of addressing market needs
 - Direction of travel has begun (e.g. HealthyCow, FeedAdvantage and EnviroCow)

The industry is ready to take on the challenge !

