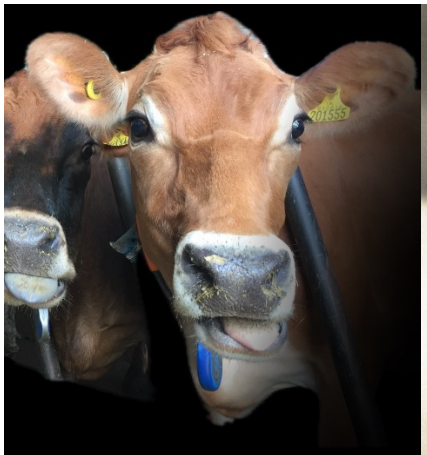


Technology's positive impact on sustainability in animal agriculture

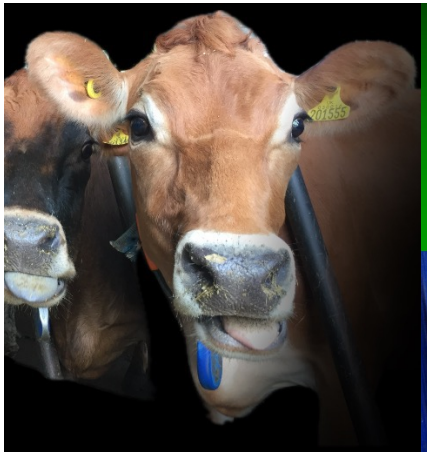
Prof. Jude Capper

6th November 2024

NIAA Animal Health Webinar

Harper Adams University

Source: Jude L. Capper, 2024



S

There is no definitive sustainable livestock system – every system can be sustainable









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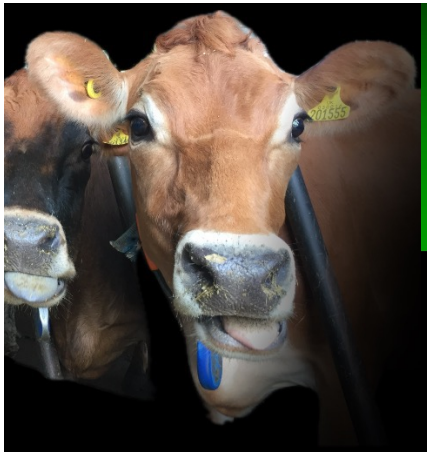
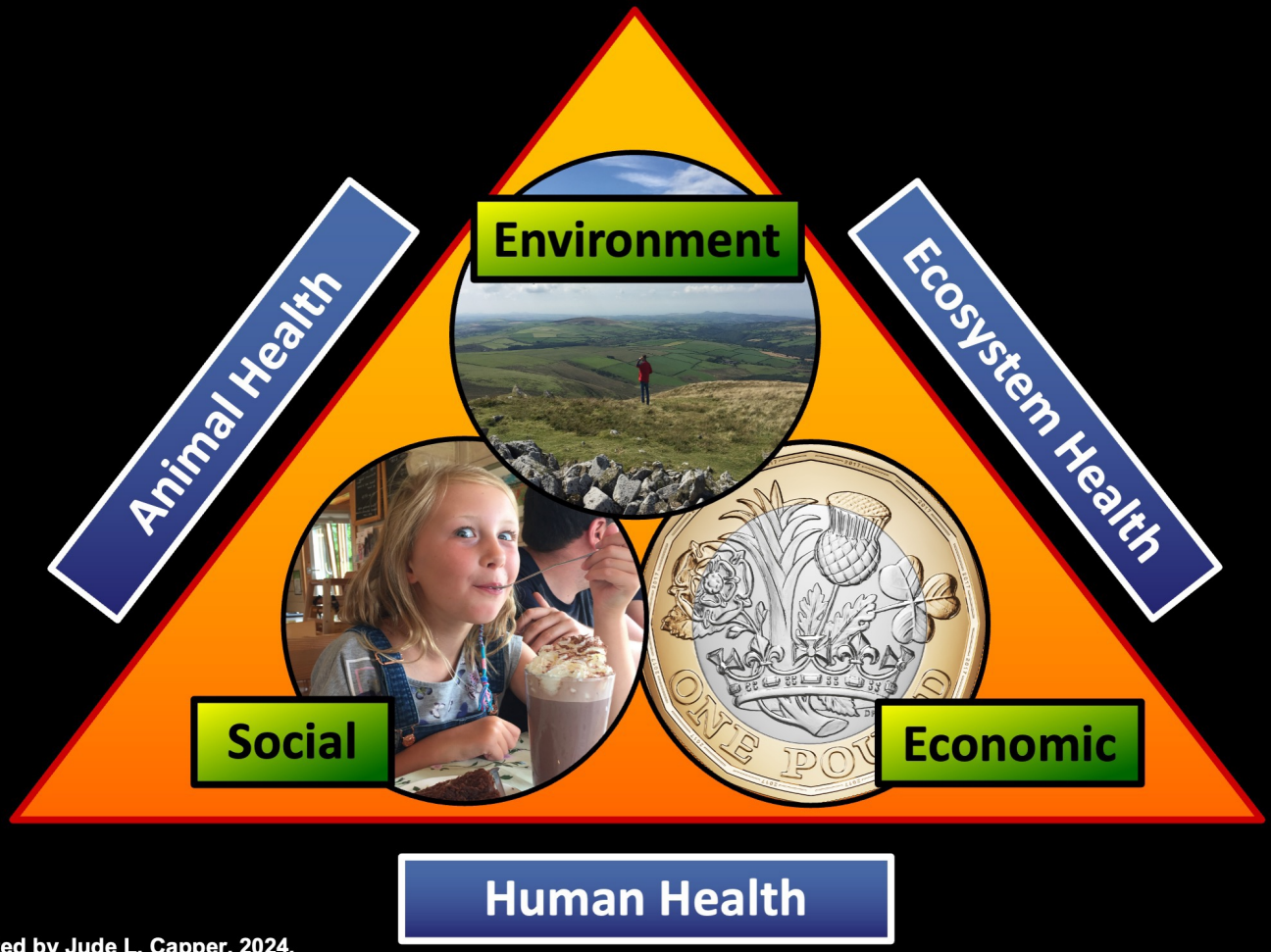
Source: Created and photos by Jude L. Capper, 2024.



S

Sustainability comprises three pillars, all under the umbrella of One Health



Source: Created by Jude L. Capper, 2024.

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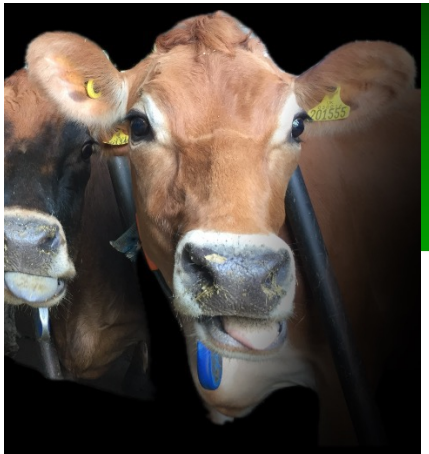
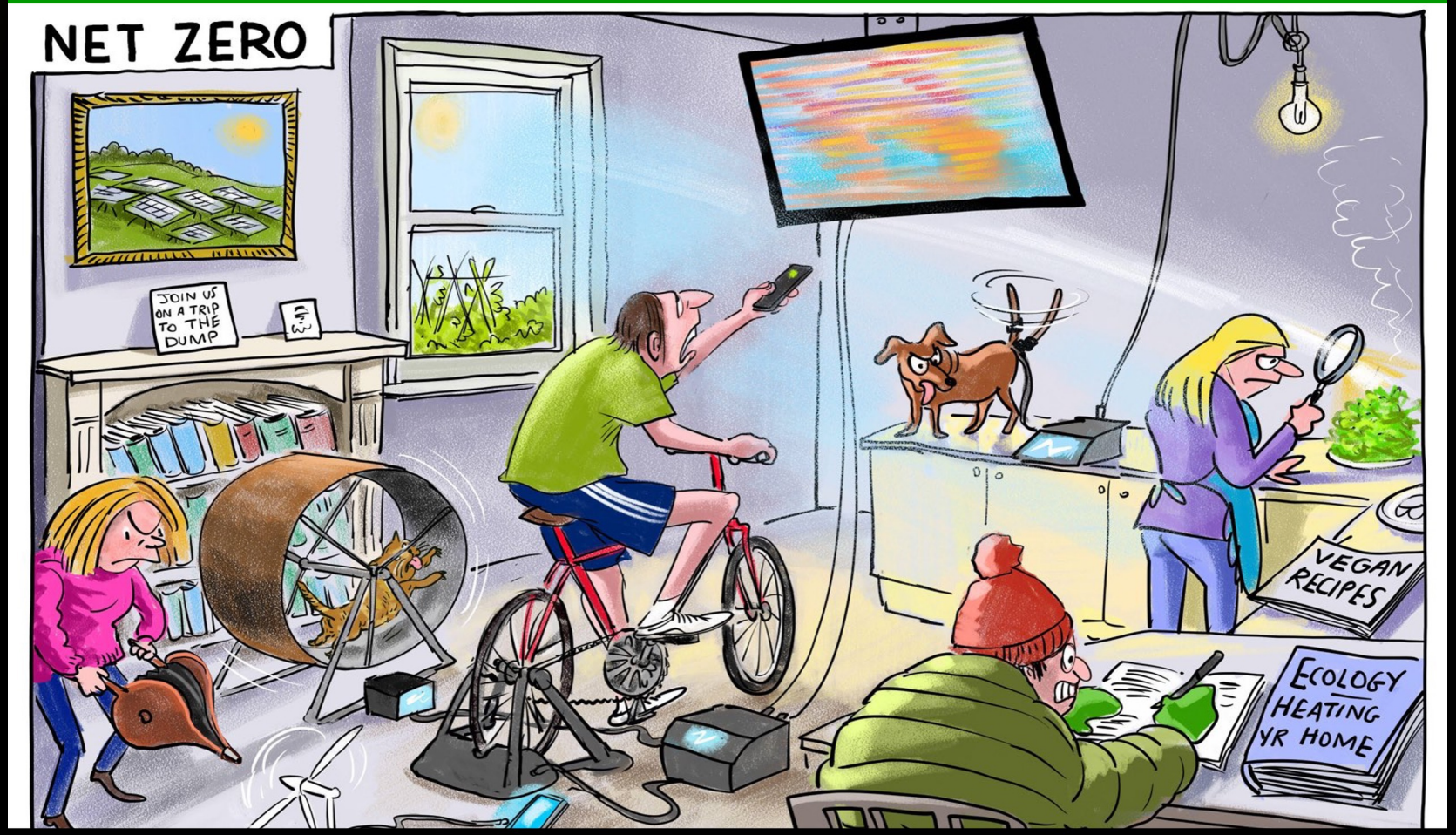


s

Net Zero is a clear priority



Source: Created by Jude L. Capper, 2024. Cartoon from: https://twitter.com/Cartoon4sale/status/1384537729460056067?s=20

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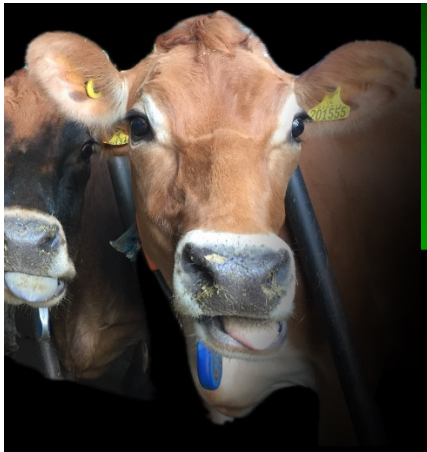
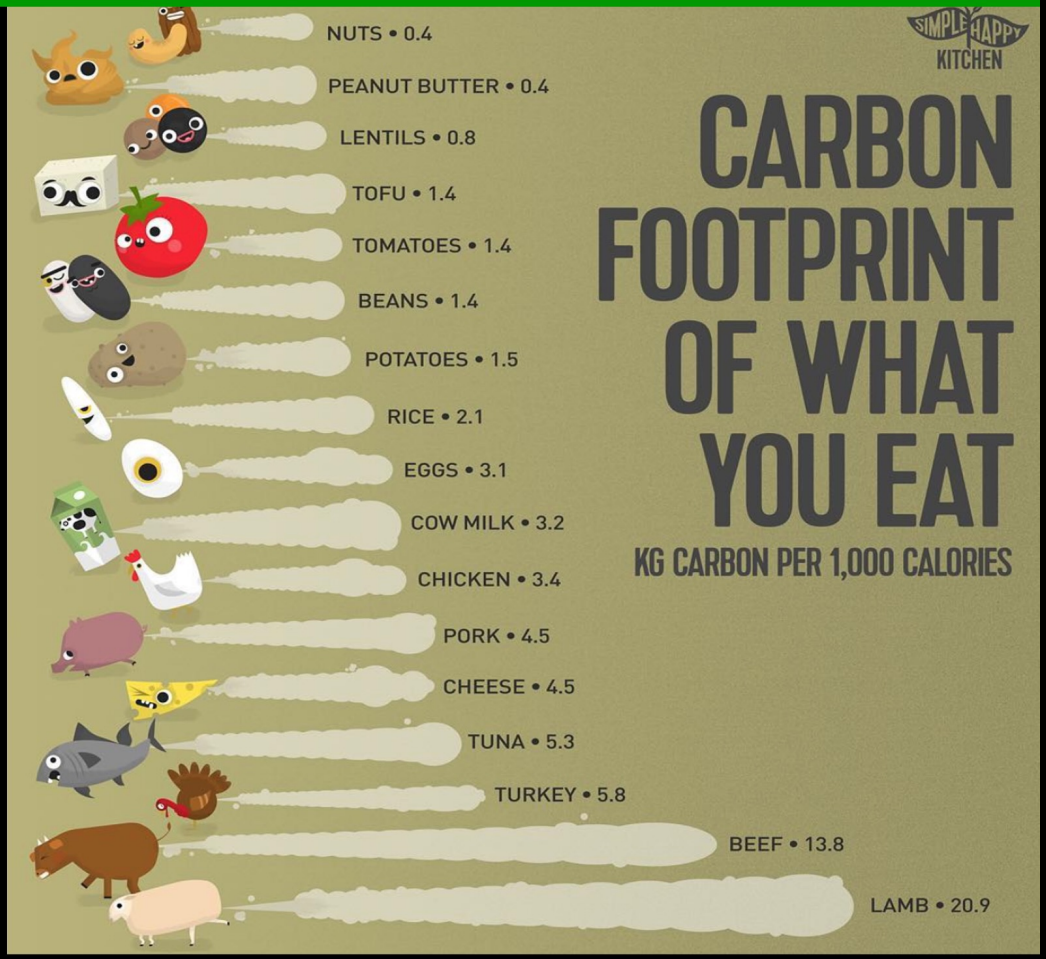


B

Global averages are meaningless

The carbon footprints of the foods we eat vary considerably – global average figures are inappropriate when food production is regional



Source: Created by Jude L. Capper, 2023. Infographic from https://www.instagram.com/simple_happy_kitchen/

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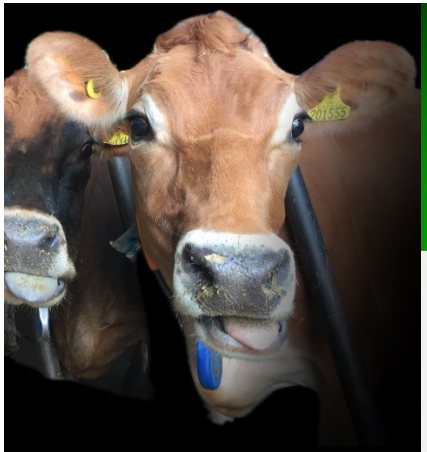
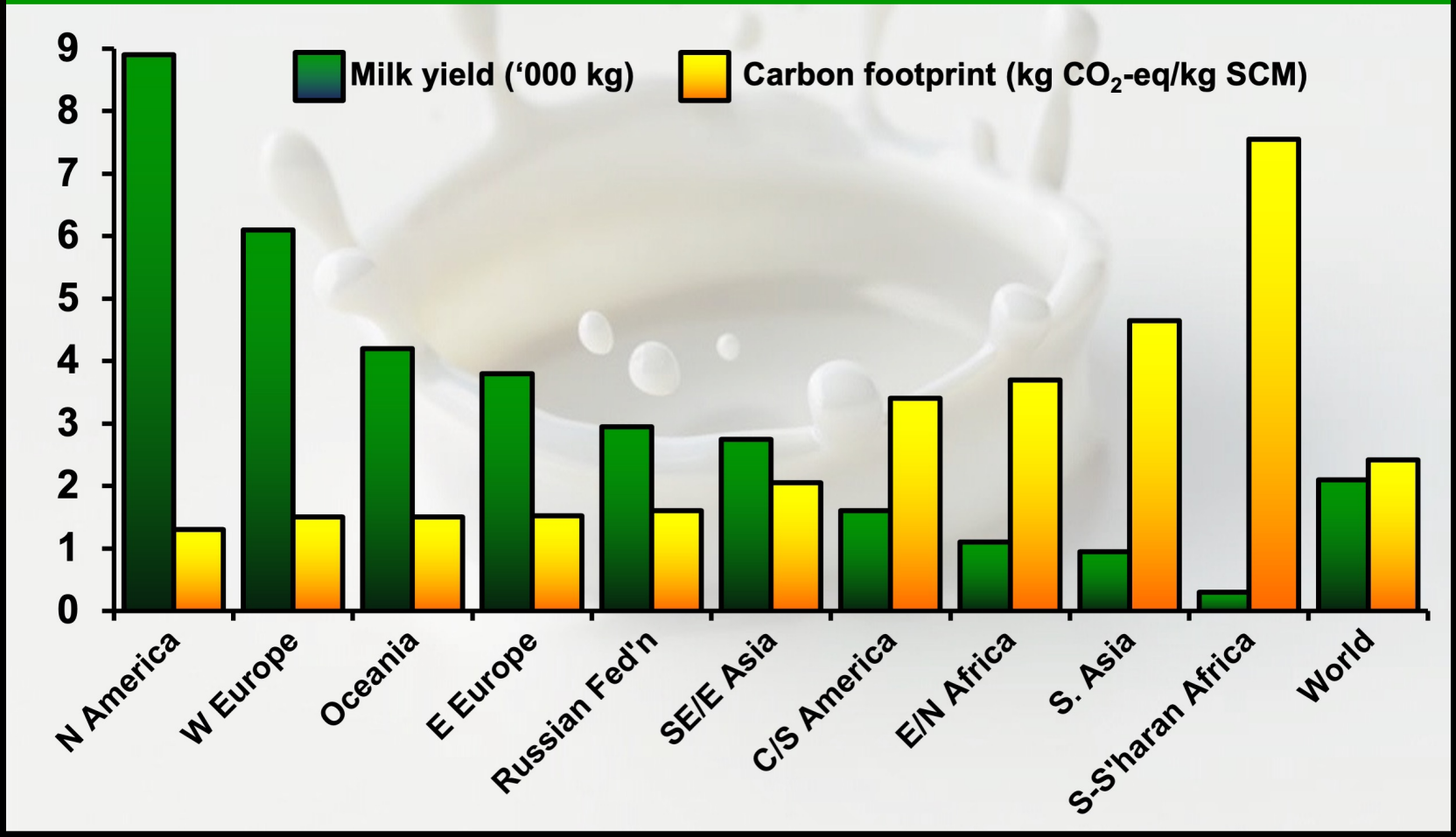


D

A negative correlation exists between milk yield and carbon emissions



Source: Created by Jude L. Capper, 2024. Data from FAO (2010) Greenhouse Gas Emissions from the Dairy Sector. FAO, Rome, Italy.

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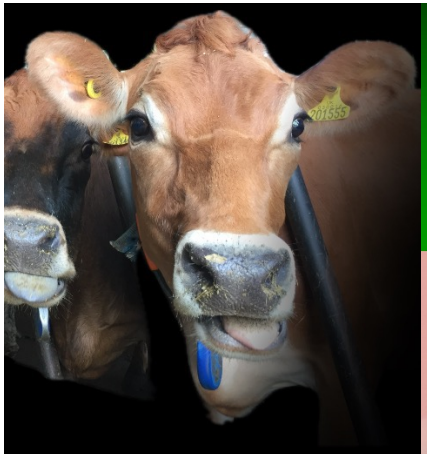
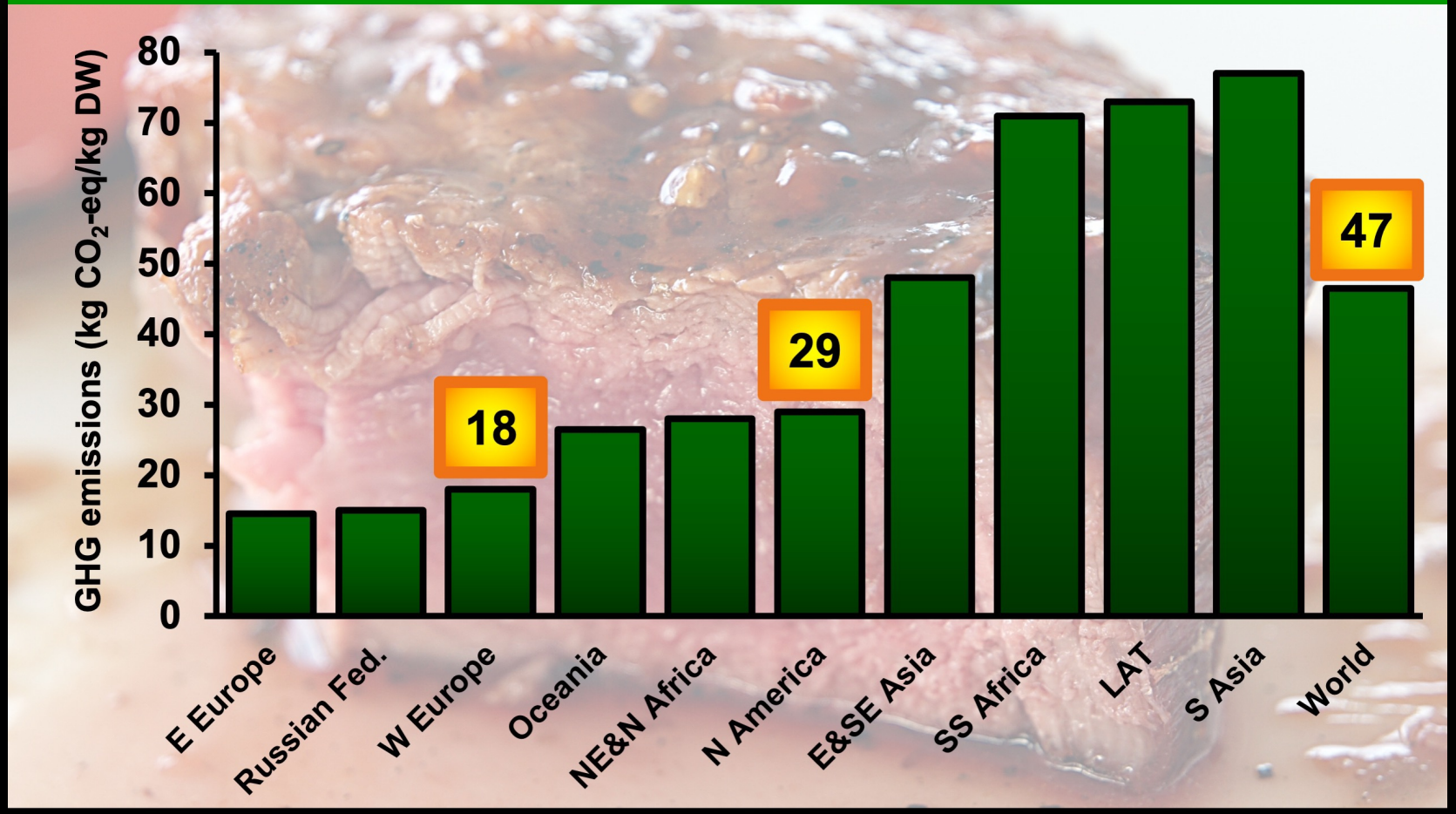


B

The carbon footprint of beef production varies across the globe



Source: Created by Jude L. Capper, 2024; data from Gerber et al. (2013) Tackling climate change through livestock – A global assessment of emissions and mitigation opportunities. FAO, Rome, Italy.

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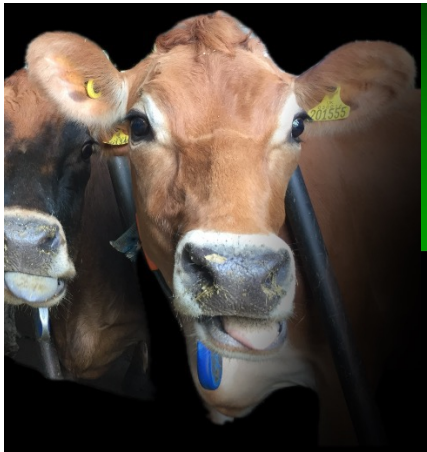
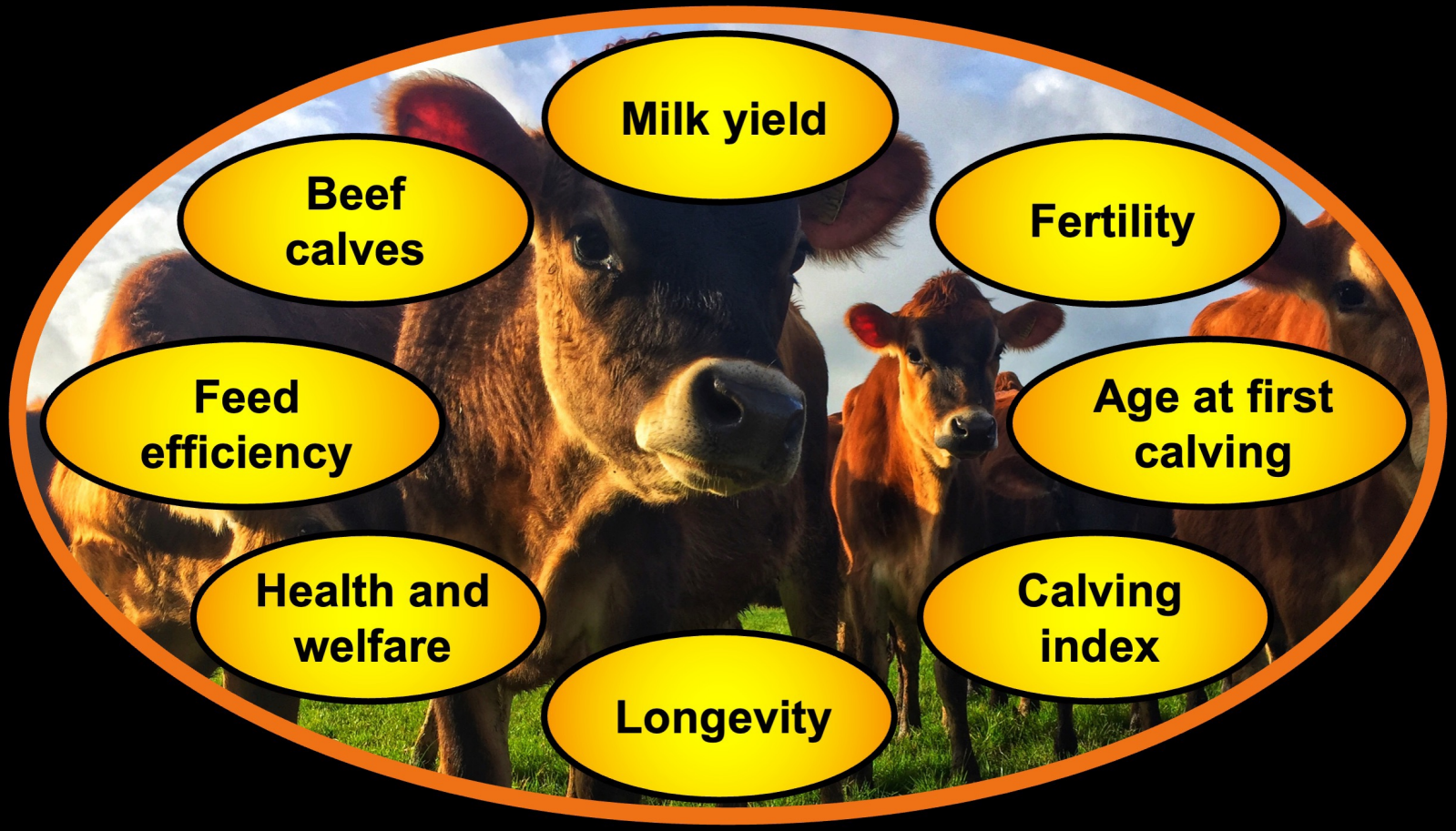


D

Improving key performance indicators reduces GHG emissions…but how do they compare?



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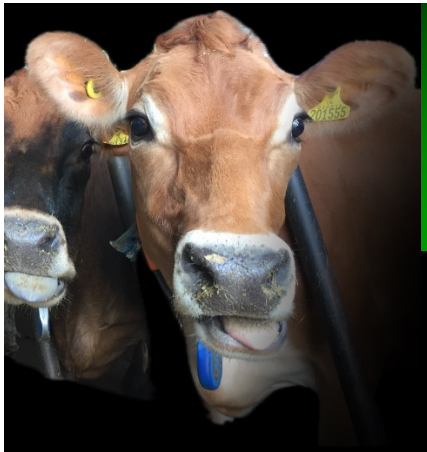
Source: Created by Jude L. Capper, 2024



AH

Disease losses are significant, but sustainability impacts are seldom quantified

More than 20% of global animal protein losses are linked to animal disease (WOAH, 2024).

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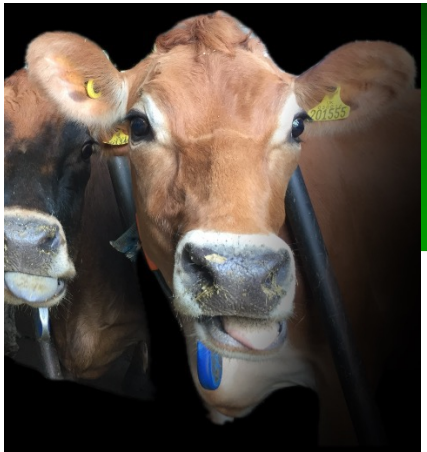
Source: Created by Jude L. Capper, 2024. Data from: Data from: World Organization for Animal Health (WOAH). 2024. https://www.woah.org/en/what-we-do/global-initiatives/one-health



AH

Animal diseases have multiple impacts on efficiency

Reduced yields

Increased mortality

Failure to conceive

Reduced growth rates

Reduced feed efficiency

Need more animals

Need more time

↑ Resource use

↑ GHGe intensity

↑ Economic costs of production

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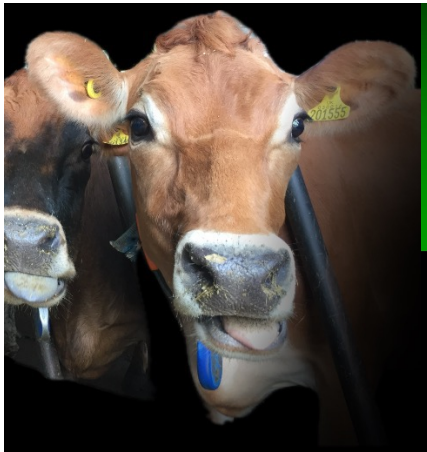
Source: Created by Jude L. Capper, 2024. Data from: Capper and Williams (2023) The Veterinary Journal. https://doi.org/10.1016/j.tvjl.2023.105988



AH

Impacts of disease on economic cost to the UK cattle industry

Mastitis

£125-384 million

BVD

£162 million

SCK

£48-212 million

Johne's

£2.8 m

Scour

£11 mil

IBR

£45 million

BRD

£60 million

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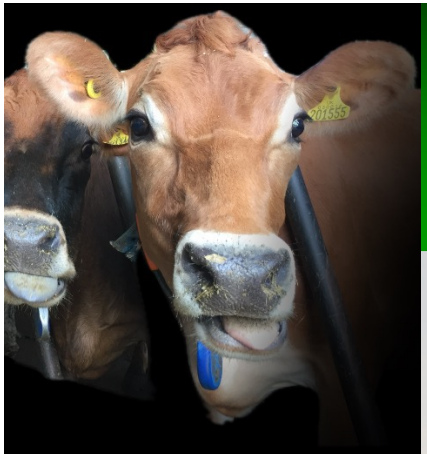
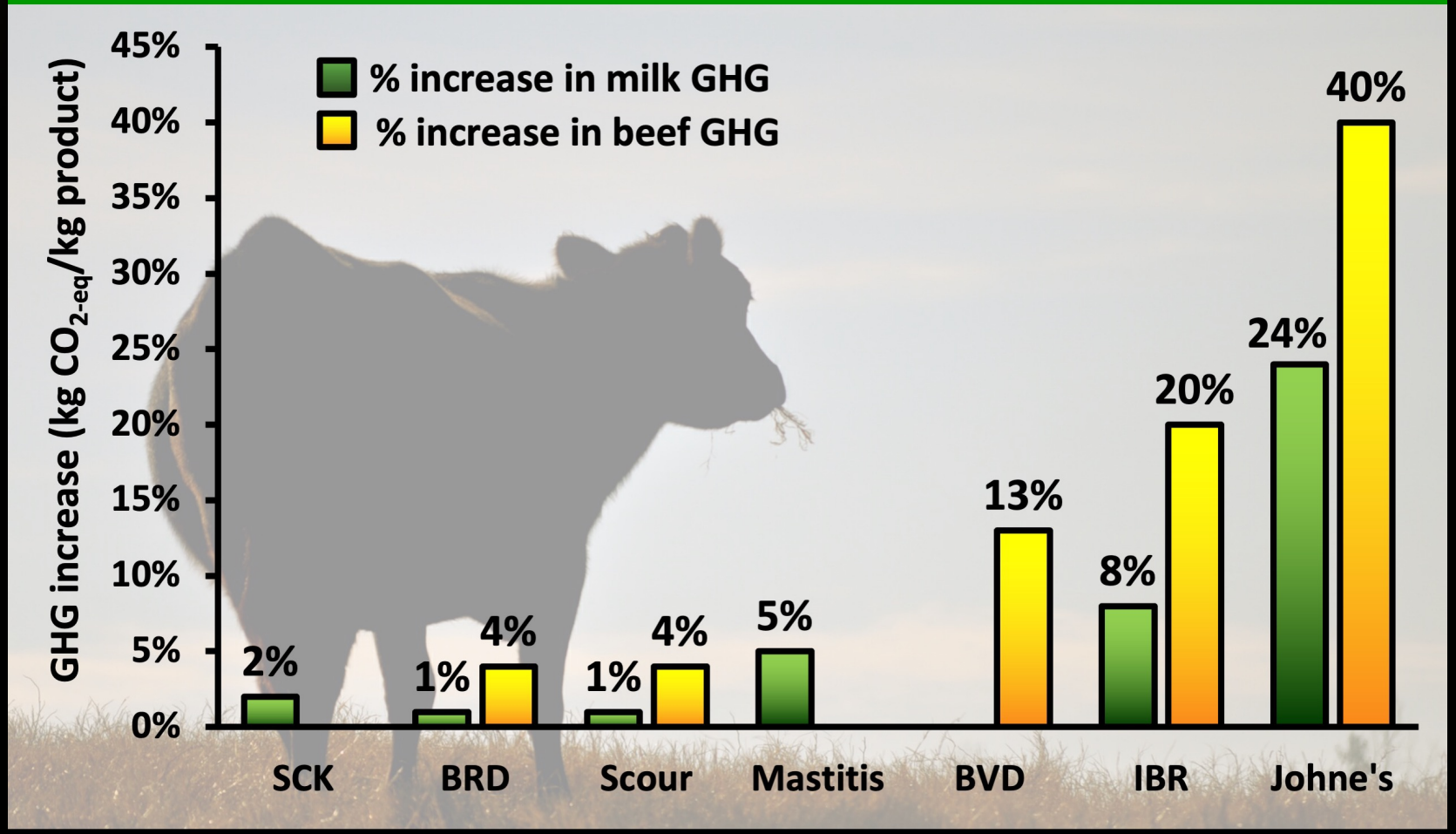
Source: Created by Jude L. Capper, 2024. More information available at: https://www.msd-animal-health-hub.co.uk/TimeToVaccinate



AH

Impacts of disease on greenhouse gas emissions per unit of beef or milk



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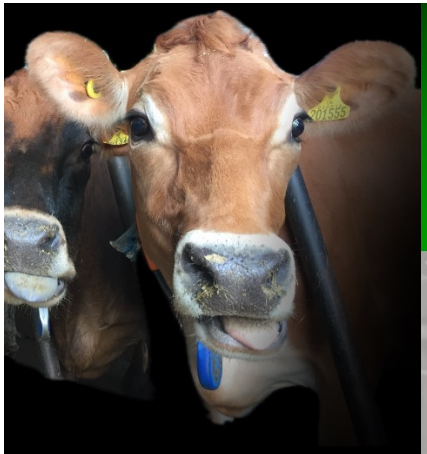
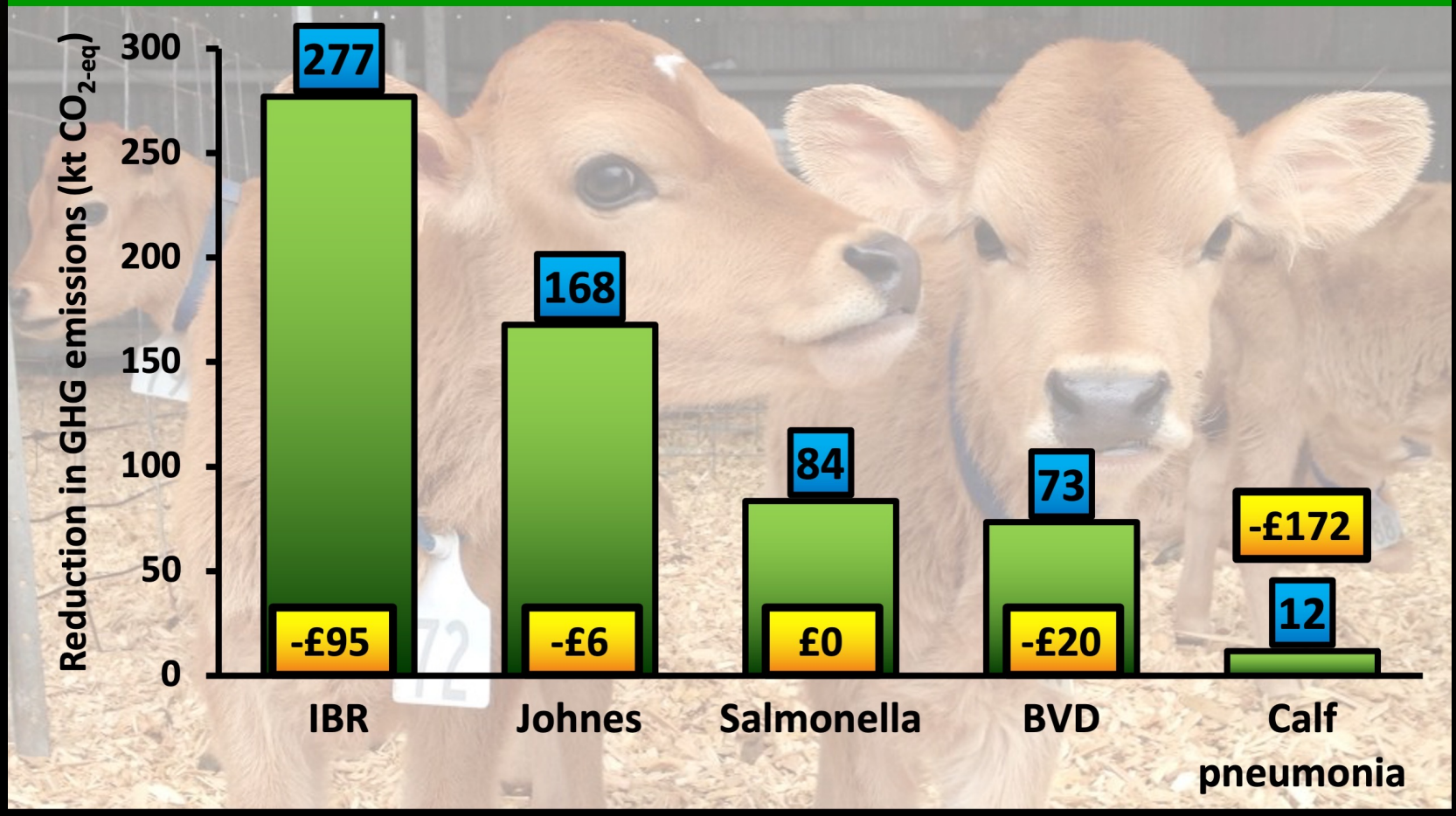
Source: Created by Jude L. Capper, 2024. More information available at: https://www.msd-animal-health-hub.co.uk/TimeToVaccinate



AH

Vaccination against endemic disease reduces GHG emissions and is cost-effective



Source: Created by Jude L. Capper, 2024. Data from: ADAS (2015) Study to Model the Impact of Controlling Endemic Cattle Diseases and Conditions on National Cattle Productivity, Agricultural Performance and Greenhouse Gas Emissions. ADAS UK Ltd, Helsby, UK.

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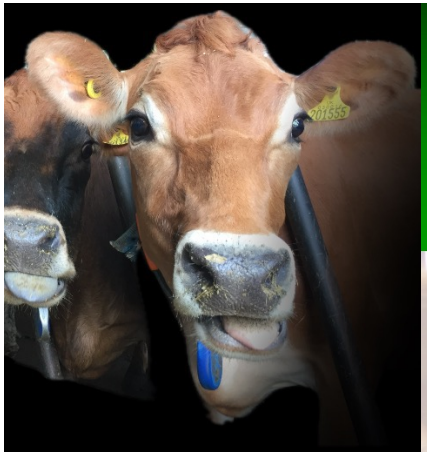
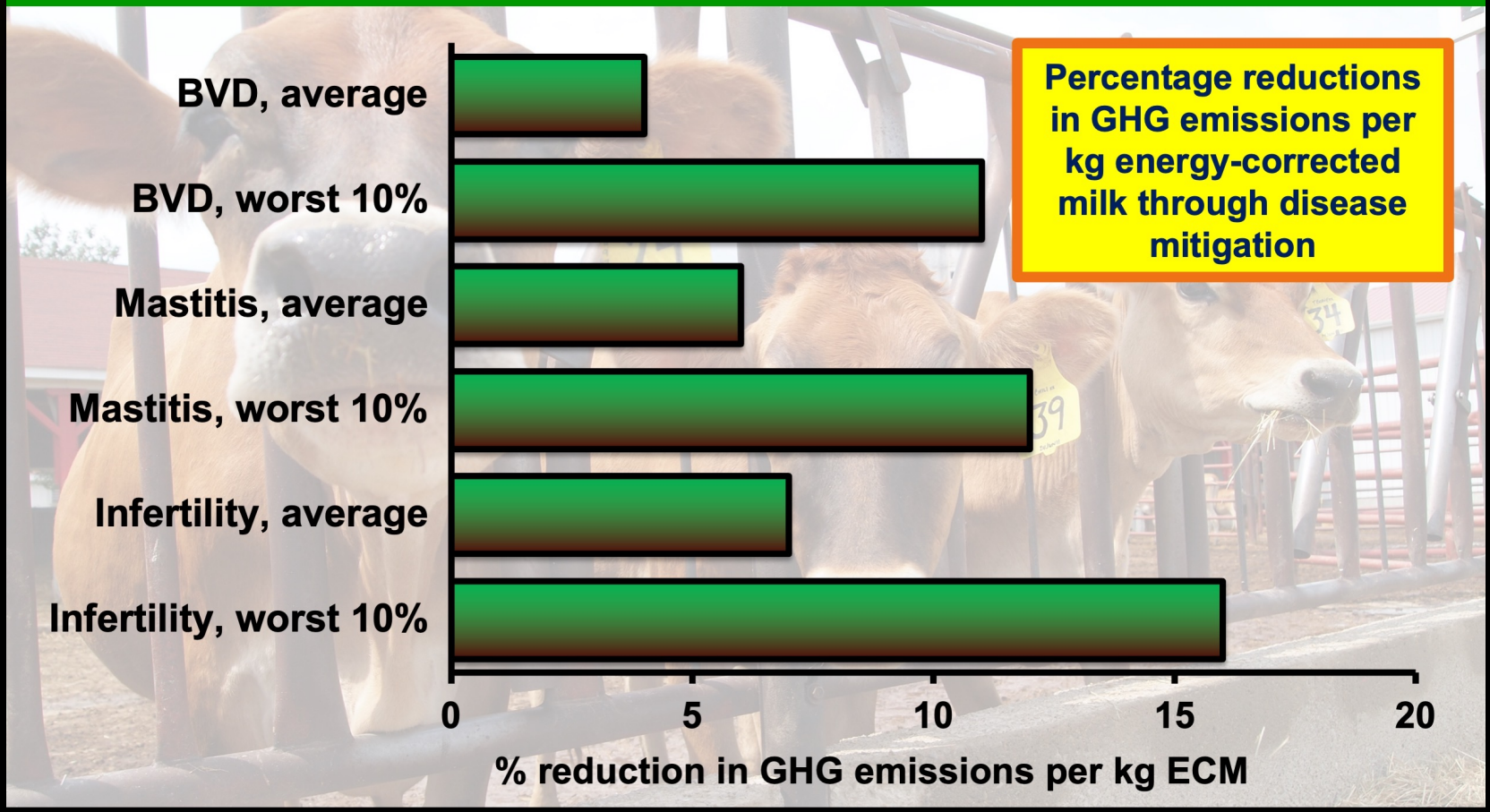


D

GHG emissions could be cut significantly by mitigating dairy diseases - UK



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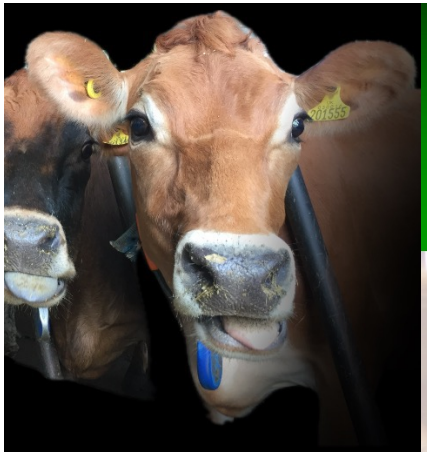
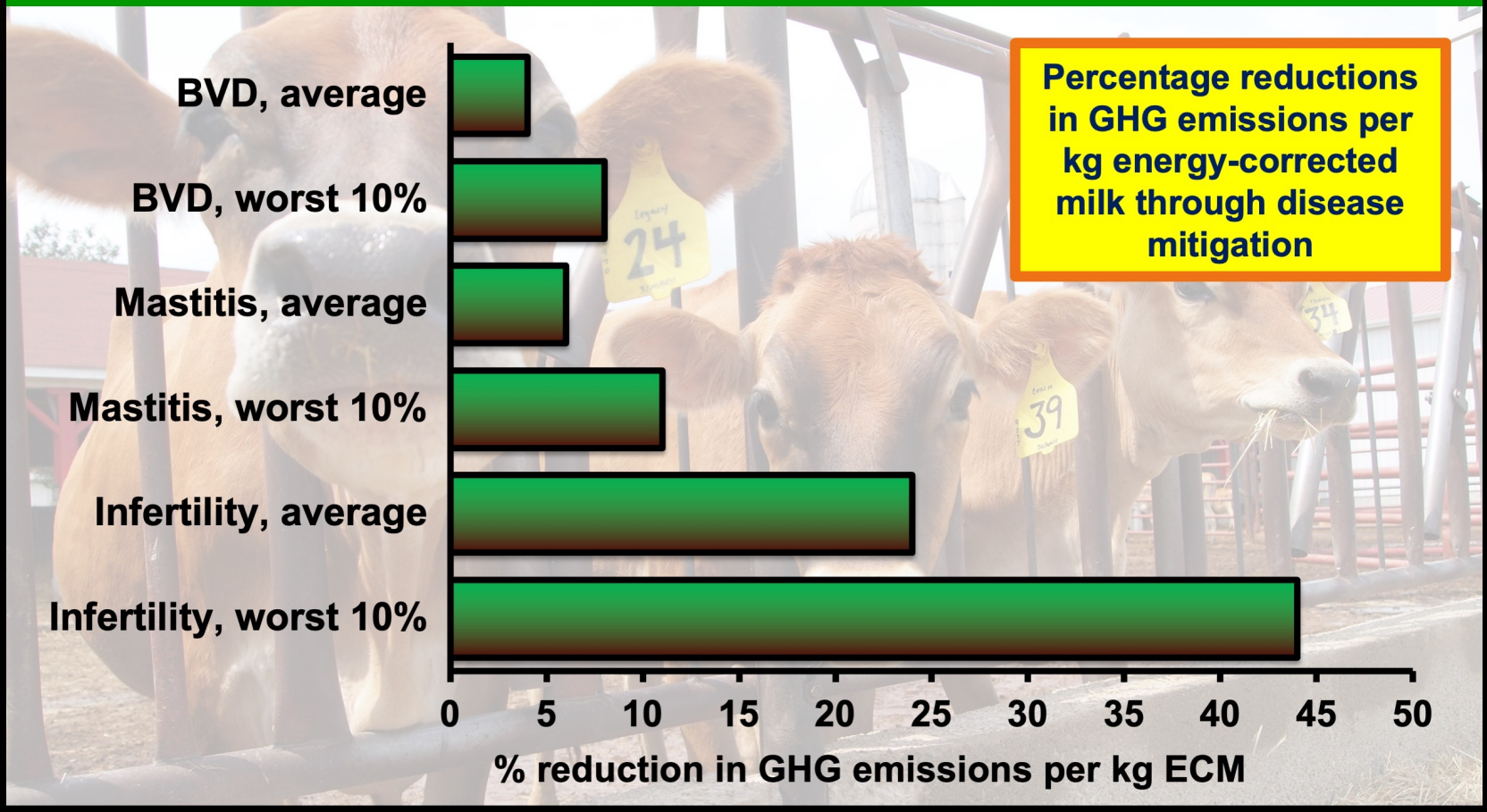
Source: Created by Jude L. Capper, 2024. Data from: Statham et al. 2021. Dairy Cattle Health and Greenhouse Gas Emissions Pilot Study: Chile, Kenya and the UK.
Available from: https://dairysustainabilityframework.org/wp-content/uploads/2020/10/Dairy-Cattle-Health-and-GHG-Emissions-Pilot-Study-Report.pdf



D

GHG emissions could be cut significantly by mitigating dairy diseases - Kenya



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Source: Created by Jude L. Capper, 2024. Data from: Statham et al. 2021. Dairy Cattle Health and Greenhouse Gas Emissions Pilot Study: Chile, Kenya and the UK.
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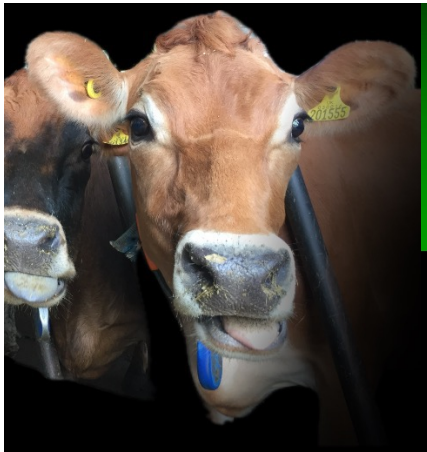
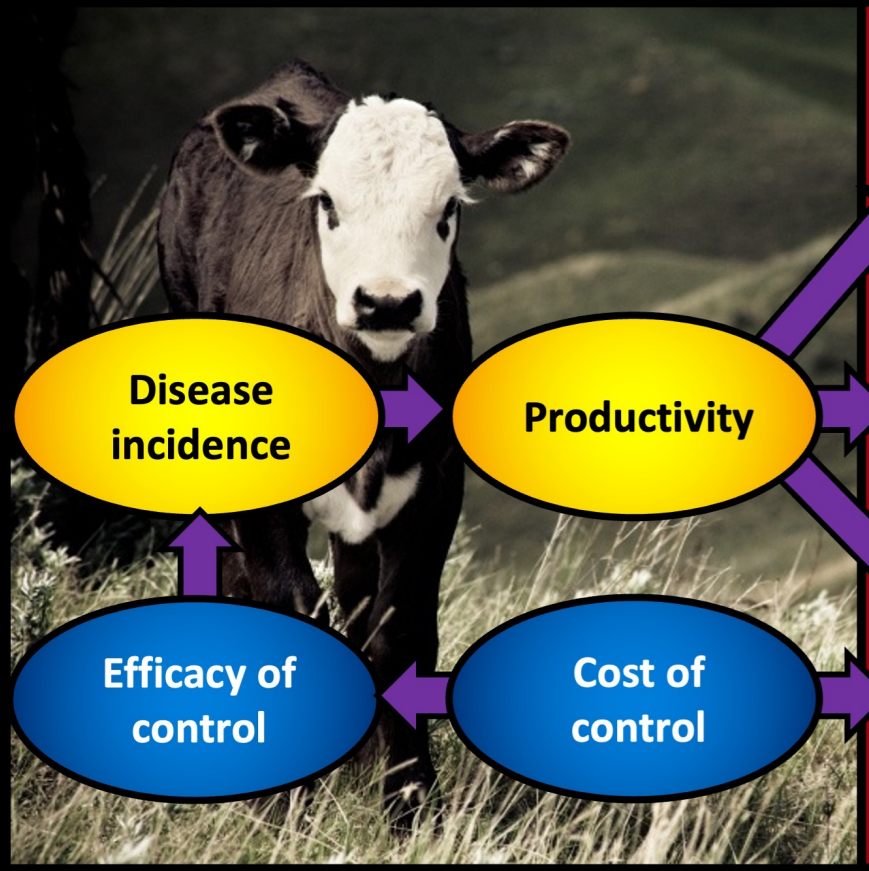


AH

More data is needed to quantify the impacts of disease on sustainability



Disease incidence

Productivity

Efficacy of control

Cost of control

Social

Environmental

Economic

Sustainability

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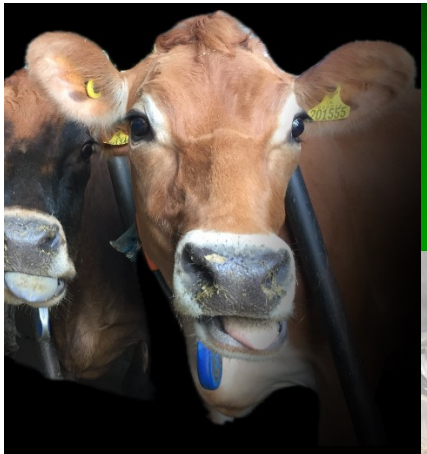
Source: Created by Jude L. Capper, 2024. More information available at: https://www.msd-animal-health-hub.co.uk/TimeToVaccinate



AH

Subclinical ketosis – subclinical ≠ low impact

Subclinical ketosis

- **25% incidence** → 2.25% increase in GHGe per tonne FPCM (Mostert et al., 2018)
- **8,882 FPCM yield/cow** → Annual increase per cow: 186 kg CO_2e
- **500-cow herd** → Annual increase per herd: 23,203 kg CO_2e
- Equal to annual emissions from 12.8 cars.

Source: Created by Jude L. Capper, 2024. Author's calculation based on data from Mostert et al. (2018) https://doi.org/10.1016/j.jclepro.2017.10.019

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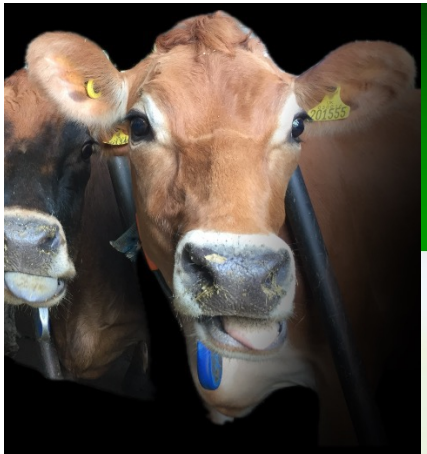
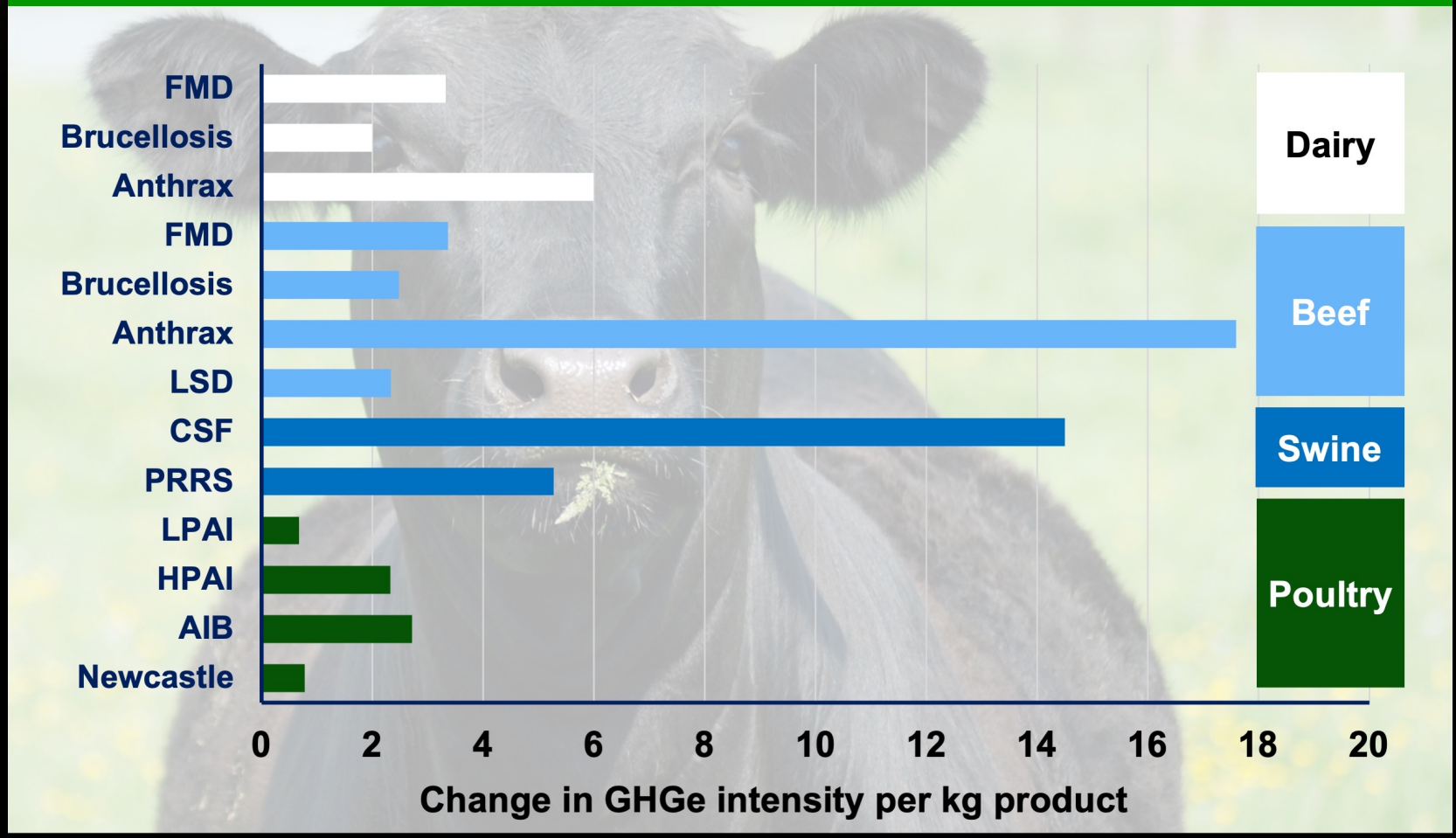


AH

Effects of diseases at 15% prevalence on livestock system GHGe



Source: Created by Jude L. Capper, 2024. Data from: Capper (2023) One Health Outlook. https://doi.org/10.1186/s42522-023-00089-y

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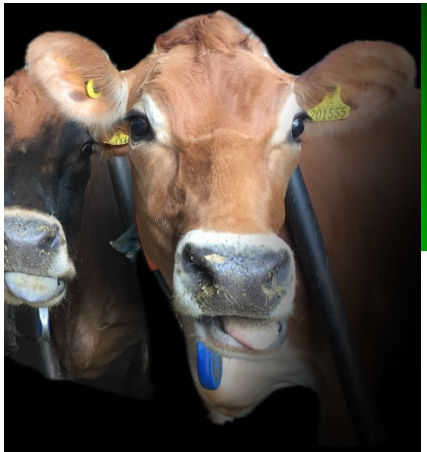

AH

Effects of disease control (vaccination) on GHGe from livestock

Livestock	Disease	Initial prevalence (%)	After disease control (%)	Change in GHGe intensity (%)
Dairy	Foot and mouth disease	45	5.0	-7.88
	Brucellosis	50	10	-4.40
Beef	Foot and mouth disease	45	5.0	-9.11
	Brucellosis	50	10	-6.90
	Anthrax	3.0	0.3	-2.79
Swine	Classical swine fever	20	5.0	-12.5
	PRRS	60	10	-22.5
Poultry	HP avian influenza	70	30	-11.2
	Avian infectious bronchitis	75	20	-11.3
	Newcastle disease	80	25	-4.74

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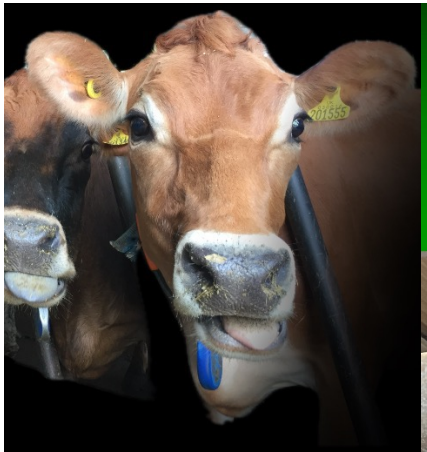
Source: Created by Jude L. Capper, 2024. Data from: Capper (2023) One Health Outlook. https://doi.org/10.1186/s42522-023-00089-y



AH

What are the wider productivity impacts?

If calf pneumonia is high on a dairy farm, what are the knock-on effects on dairy beef production?

What about suckler production?

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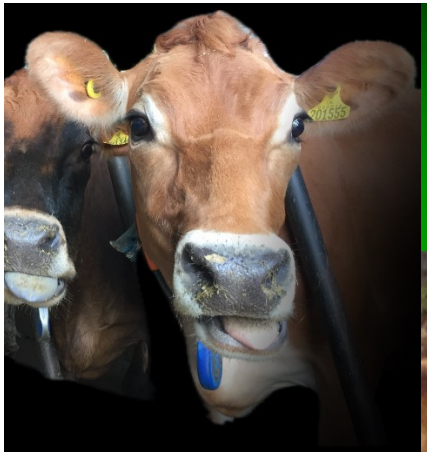
Source: Created by Jude L. Capper, 2023. Data from: Capper & Williams (2023) https://doi.org/10.1016/j.tvjl.2023.105988



D

What are the milk, meat and greenhouse gas implications of global dairy cow mortality?

Annual milk yield	Milk lost if cow dies	Meat lost if cow dies	Extra GHG emissions
4,500 kg	8,537 kg	430 kg CW	3,751 kg CO_2e

Source: Created by Jude L. Capper, 2024. Calculated as an example based on a 4,500 kg annual milk yield, 26 mo age at first calving, 14 mo calving interval, 248 kg carcass weight, 0.69 live calves born/yr, 0.50 calves reared for beef, and average of 1,731 kg CO_2e GHG emissions per heifer/yr.

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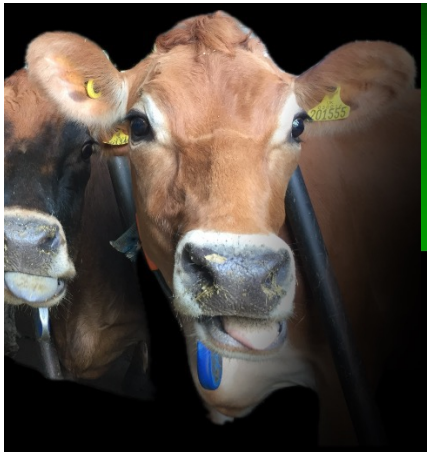

AH

“Real life” application – African swine fever

The recent African swine fever outbreak, in which 150-200 million pigs died (30% of Chinese herd), led to:

- **17-38% increase in global pork prices**
- **Pigmeat losses would have fed 403-538 million people**
- **Greenhouse gases invested in animals that died or were culled were equal to annual emissions of 16.7-25.1 million cars**

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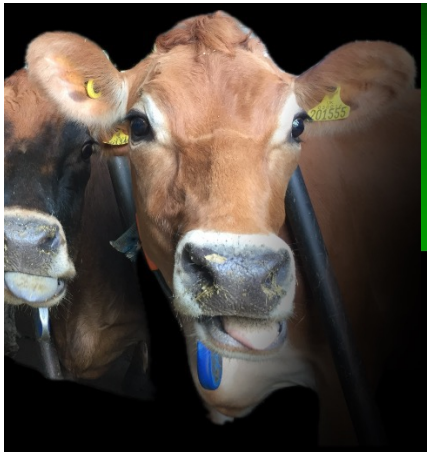
Source: Created by Jude L. Capper, 2024. Economic data from Mason-D’Croz et al. (2020) https://doi.org/10.1038/s43016-020-0057-2 and Capper (2023) One Health Outlook. https://doi.org/10.1186/s42522-023-00089-y



AH

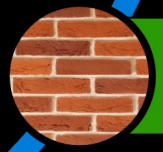
Barriers to investing in livestock health

Availability of medicines

Lack of infrastructure

Lack of capacity to address disease

Lack of awareness of economic gains



Unwillingness to change

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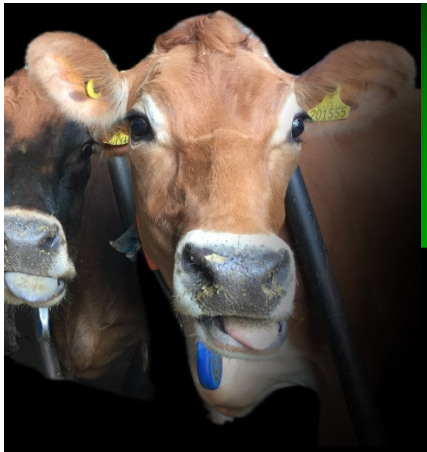
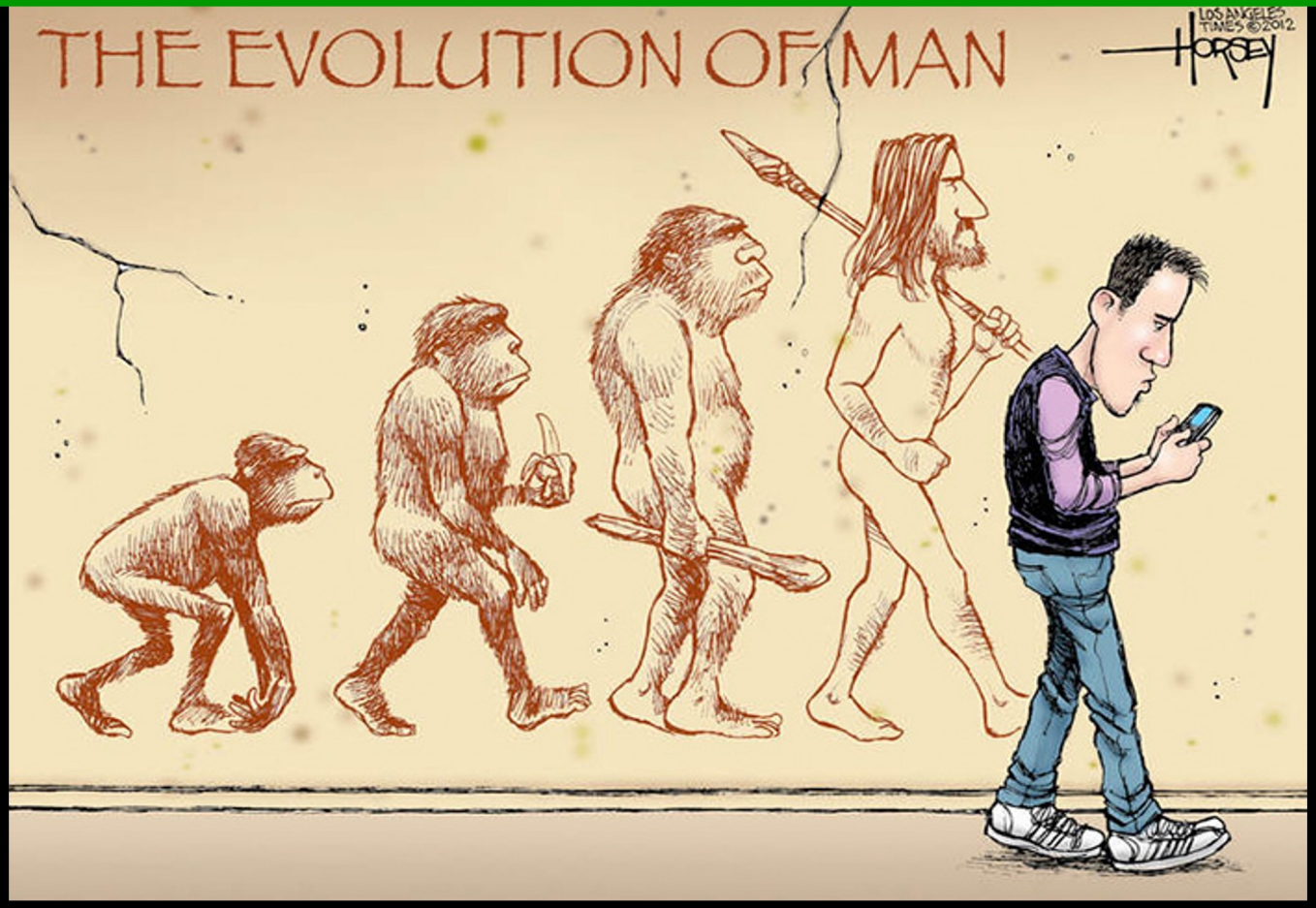
Source: Created by Jude L. Capper, 2024



COM

We've got the technology – now we need to use it to its potential



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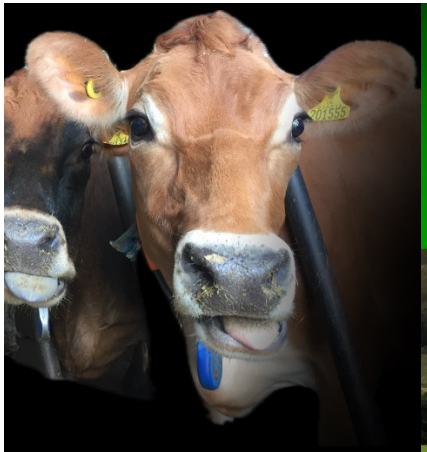
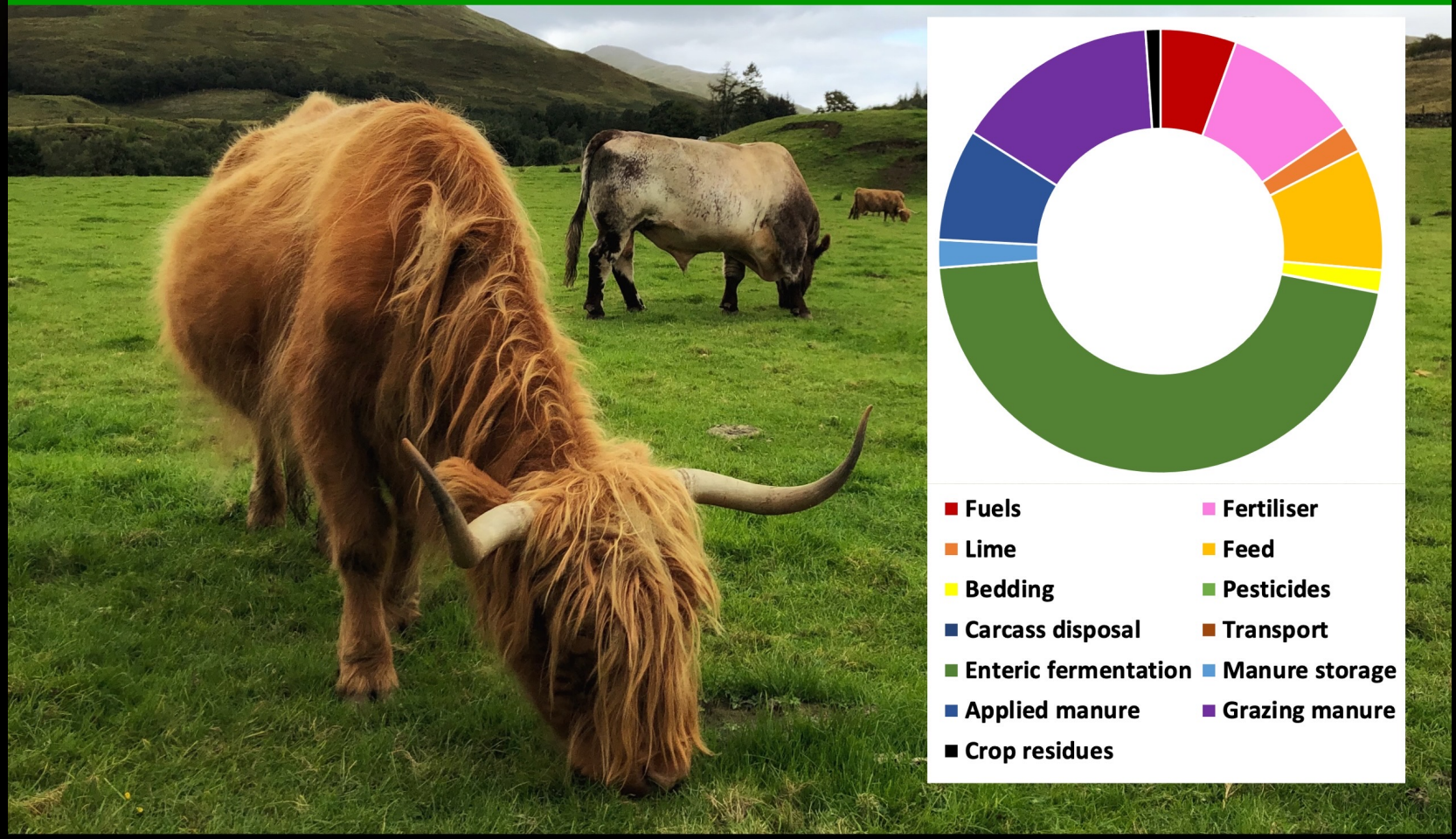
Source: Created by Jude L. Capper, 2023. Cartoon from: https://static.boredpanda.com/blog/wp-content/uploads/2016/02/funny-satirical-evolution-charles-darwin-day-251__700.jpg



s

Standard footprinting tool urgently needed across the industry



Source: Created by Jude L. Capper, 2023. Example carbon footprint results based on a beef finishing farm.

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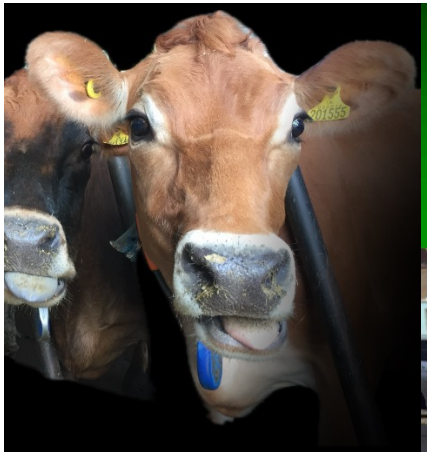

COM

Our biggest challenge is to keep meat and dairy in the diets of future food purchasers

Source: Created by and photo from Jude L. Capper, 2023.

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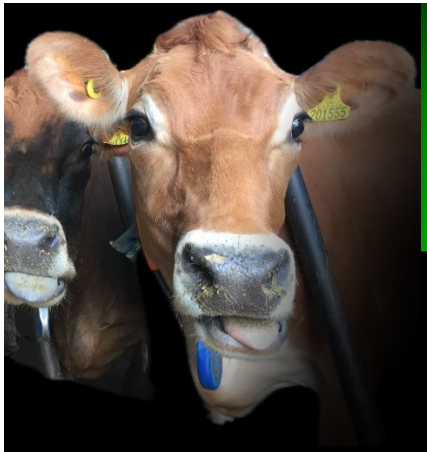

COM

Guilt is a primary motivator for people considering going vegetarian or vegan

"I sometimes feel guilty when consuming meat and dairy products"

66% of meat-eaters and flexitarians thinking of giving up meat said "yes" compared to 25% of national population

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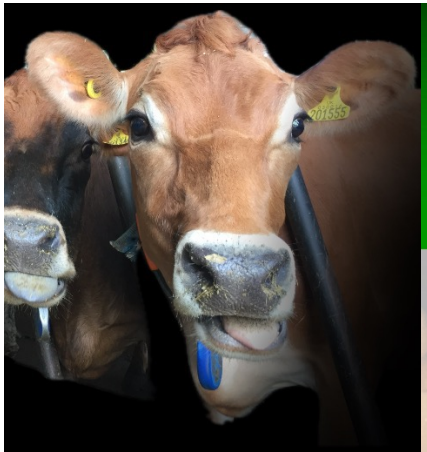
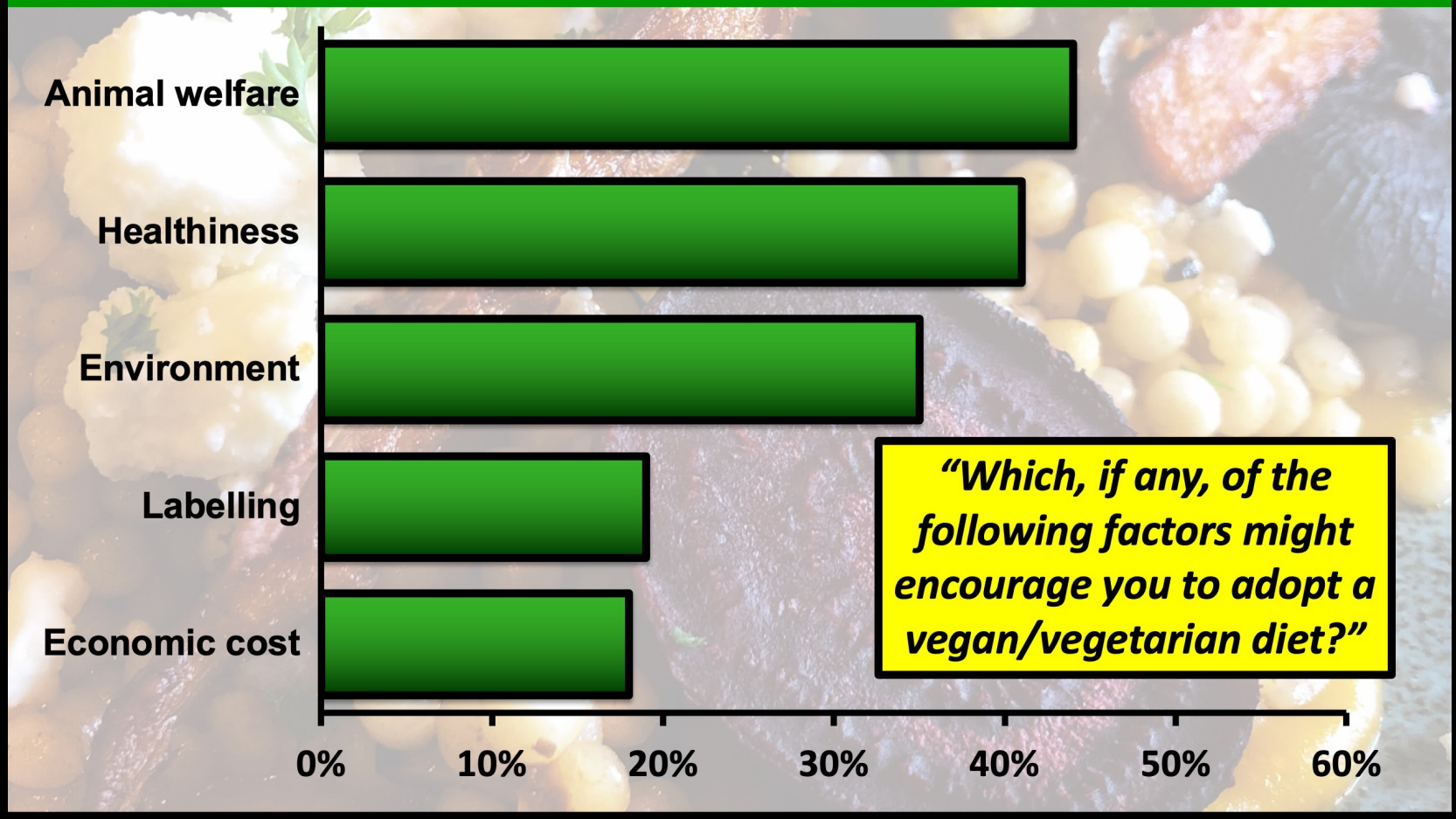
Source: Created by Jude L. Capper, 2023. Information from YouGov (2019) Is the future of food flexitarian? https://yougov.co.uk/topics/resources/articles-reports/2019/03/18/future-food-flexitarian



COM

Animal welfare, health and the environment are primary consumer concerns



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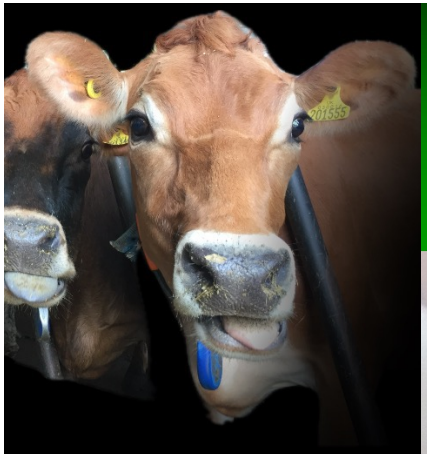
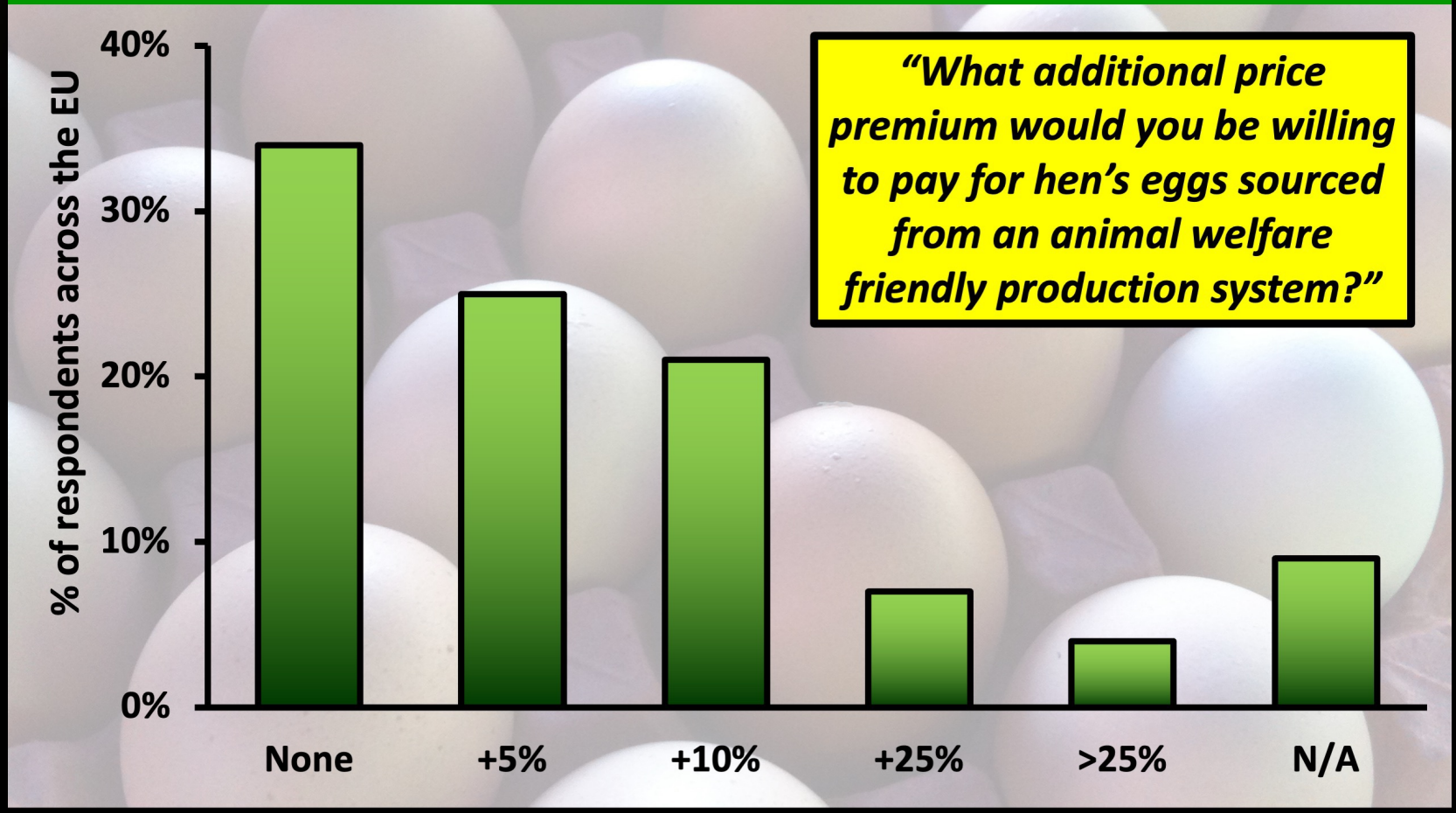


AH

94% of EU respondents said it was important to protect welfare…but few will pay for it



Source: Created by Jude L. Capper, 2024. Data from Eurobarometer (2016) Special Eurobarometer 442. Attitudes of Europeans Towards Animal Welfare. Available from: https://europa.eu/eurobarometer/surveys/detail/2096

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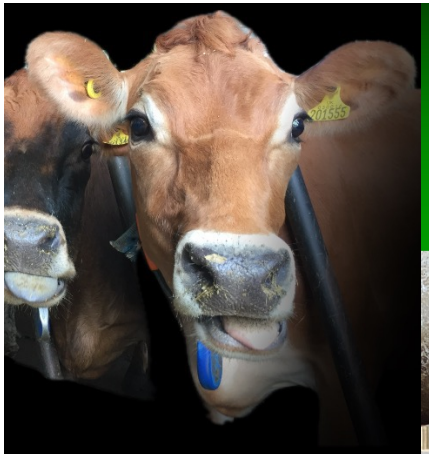

B

Is there always a trade-off between low carbon and high welfare?

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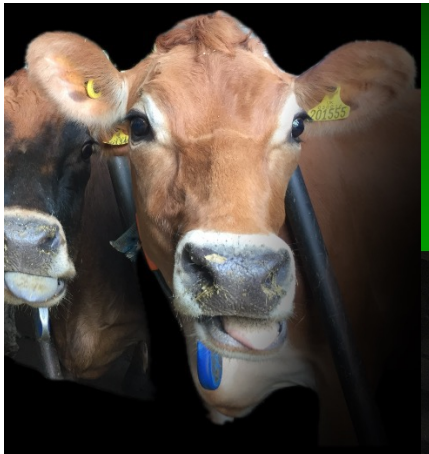
Source: Created and photos by Jude L. Capper, 2024.



D

Does this farm have good welfare?

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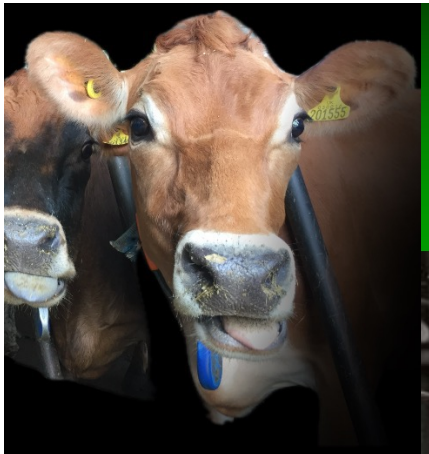
Source: Created and photo by Jude L. Capper, 2024.



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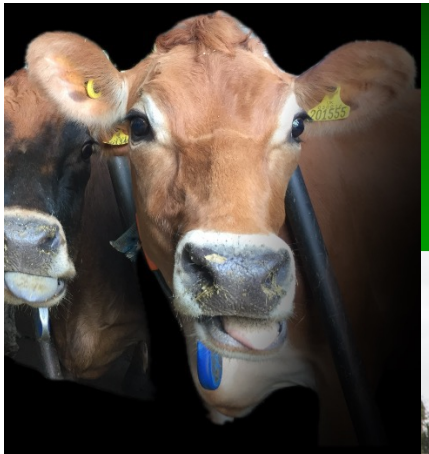

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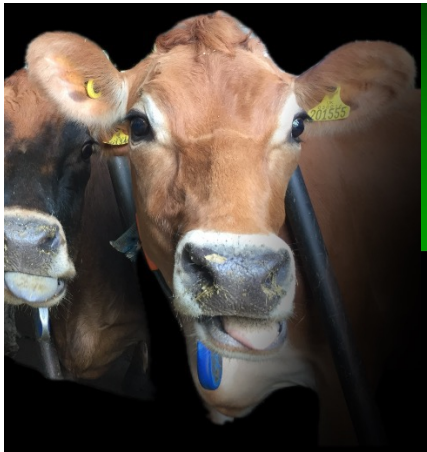

AH

How can we improve?

- Take a whole-herd, holistic approach
- Use on-farm medicines responsibly
- Use vaccination where appropriate
- Record and benchmark health data
- Record performance and economic impacts
- Communicate dedication to livestock health

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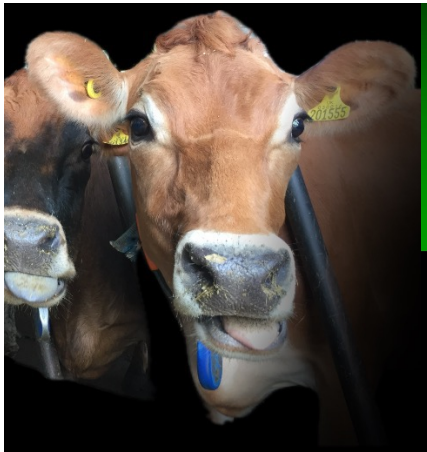
Source: Created by Jude L. Capper, 2024. More information available at: https://www.msd-animal-health-hub.co.uk/TimeToVaccinate



AH

What must we do to move forwards?

Implement disease interventions

Improve data collection and surveillance

Understand impact of subclinical disease

Understand effects of disease interactions

Emphasise health in mitigation protocols

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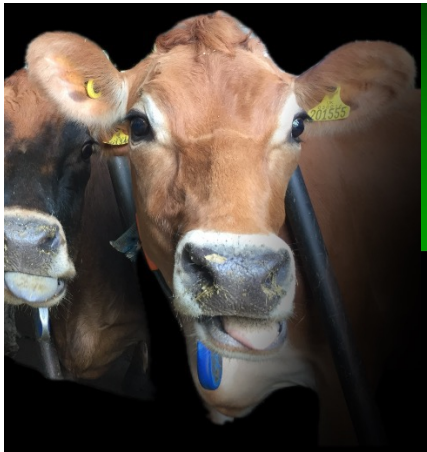

B

Thank you!

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Questions?

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Source: Created by Jude L. Capper, 2024. Cartoon from: http://snipurl.com/methanecartoon