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Sustainability challenges for dairy - where are the knowledge gaps?

Dr. Jude L. Capper

14th October 2021

Source: Dr. Jude L. Capper, 2021

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There is no definitive sustainable protein system – but every system can be sustainable

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Source: Created and photos by Dr. Jude L. Capper, 2020

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COM

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

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Source: Created by and photo from Dr. Jude L. Capper, 2019.

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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

**No guilt
34%**

**Feel guilty
66%**



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Source: Created by Dr. Jude L. Capper, 2020. 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

Welfare, health and environmental concerns are paramount for people giving up dairy

Animal welfare

Healthiness

Environment

Labelling

Economic cost



“Which, if any, of the following factors might encourage you to adopt a vegan/vegetarian diet?”

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Source: Created by Dr. Jude L. Capper, 2021. Information from: YouGov (2019) Is the future of food flexitarian?
<https://yougov.co.uk/topics/resources/articles-reports/2019/03/18/future-food-flexitarian>

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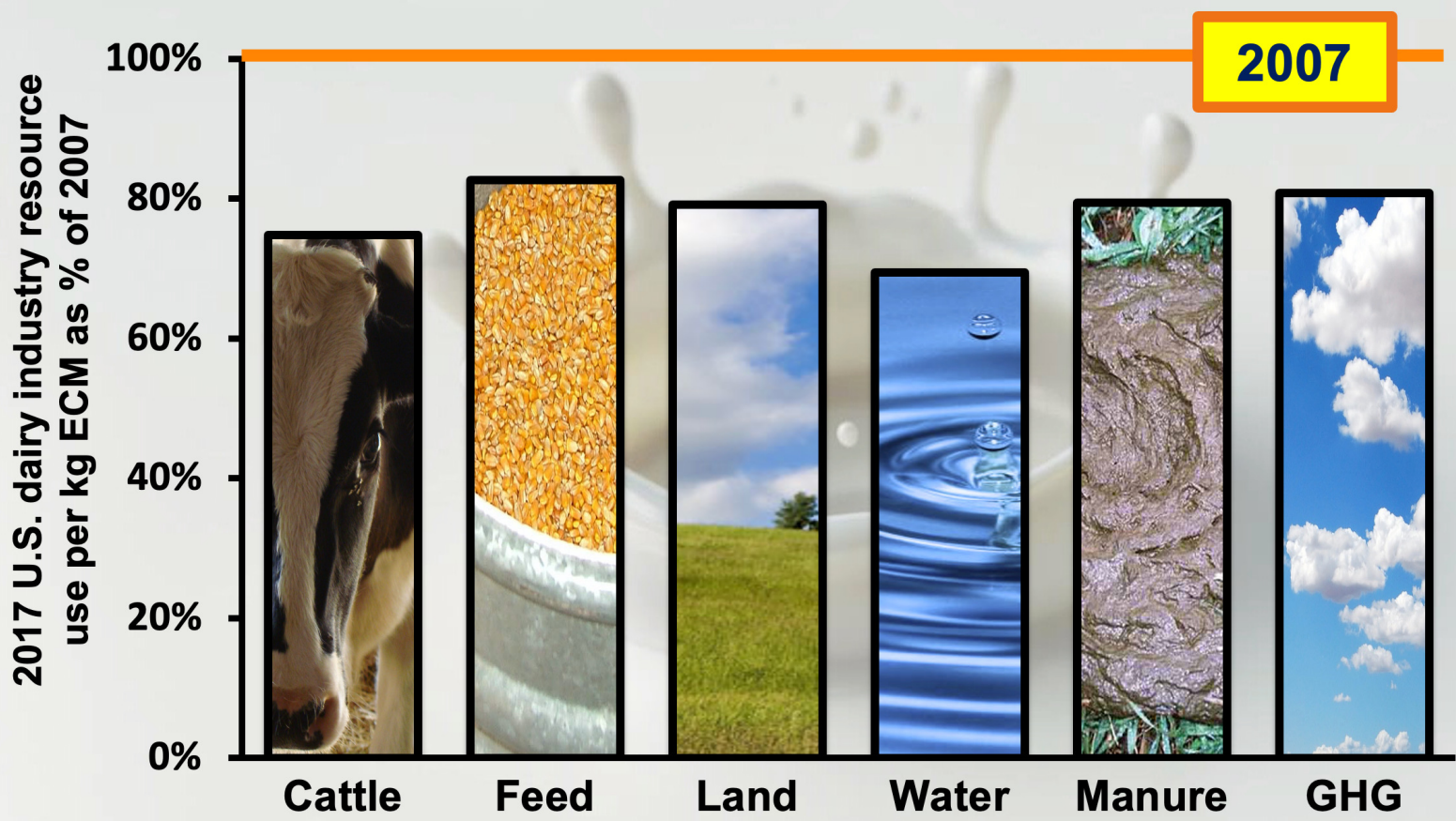
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D

We can benchmark industry progress over time, yet still have no standard on-farm tool



Source: Created by Dr. Jude L. Capper, 2021. Data from: Capper, J. L. and Cady, R. A. 2019. The effects of improved performance in the U.S. dairy cattle industry on environmental impacts between 2007 and 2017. *Journal of Animal Science*. <https://doi.org/10.1093/jas/skz291>

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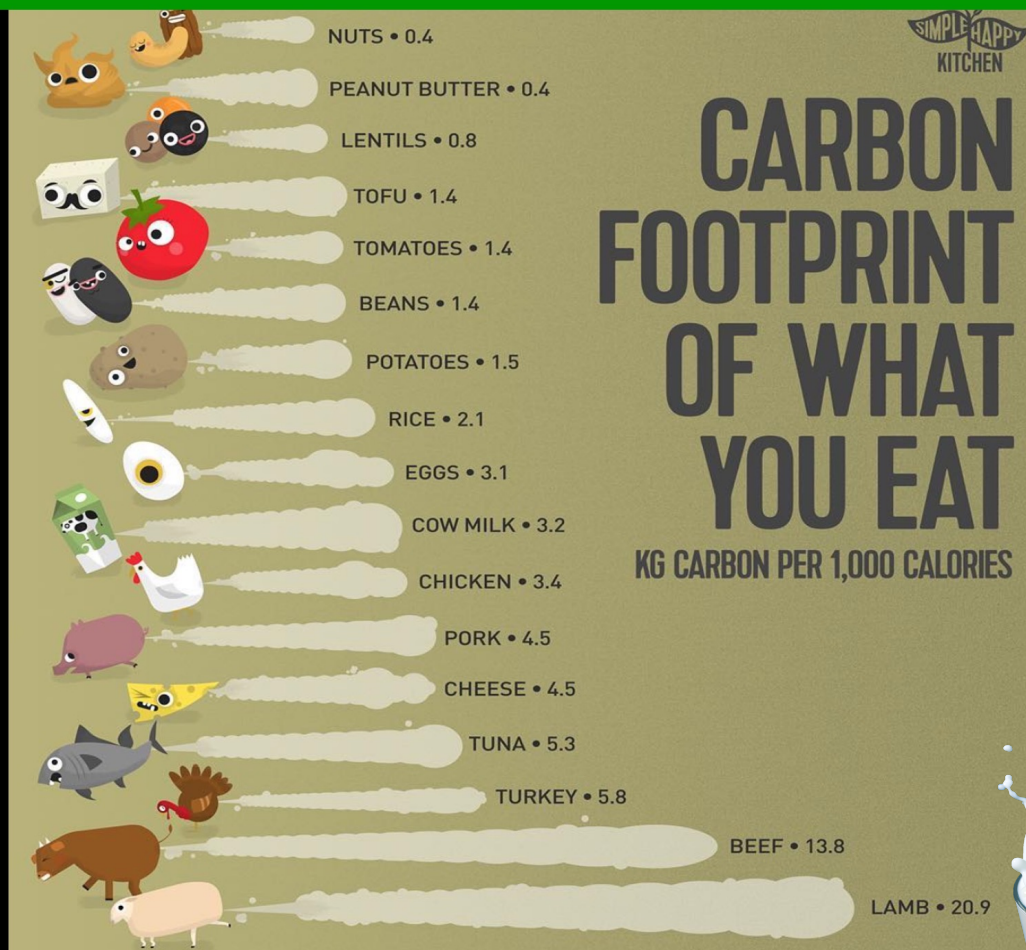
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B

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 Dr. Jude L. Capper, 2020, infographic from: https://www.instagram.com/simple_happy_kitchen/

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D

Methane emissions factors must be applicable to cattle, feed and system



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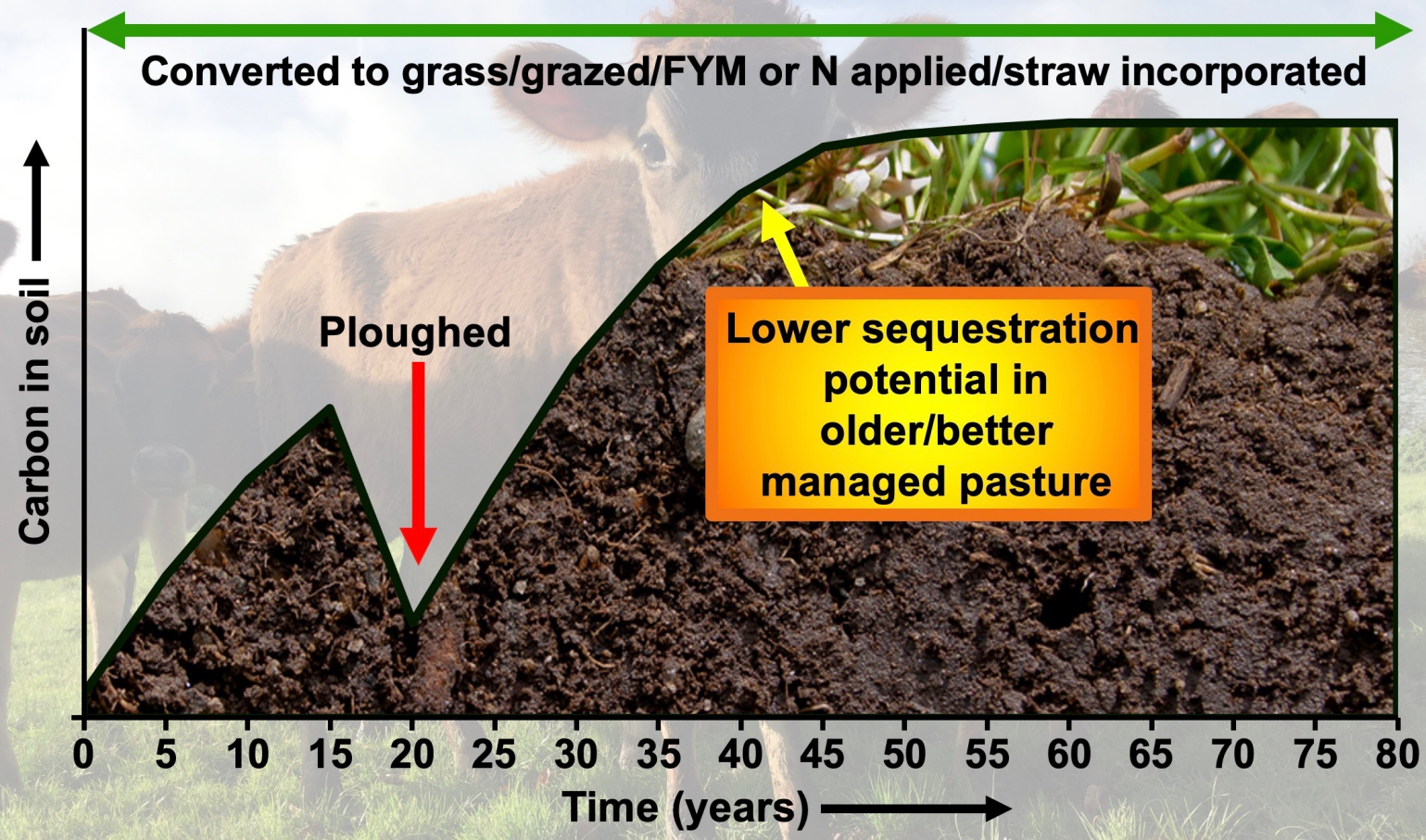
Source: Created by Dr. Jude L. Capper, 2021. Photo attribution: Mullokkaran, CC BY-SA 3.0 <<https://creativecommons.org/licenses/by-sa/3.0/>>, via Wikimedia Commons

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s

Carbon sequestration offers promise – but isn't a magic bullet



Source: Created by Dr. Jude L. Capper, 2020 as an example of soil carbon sequestration. Data from: Poulton et al. (2017) *Global Change Biology*.

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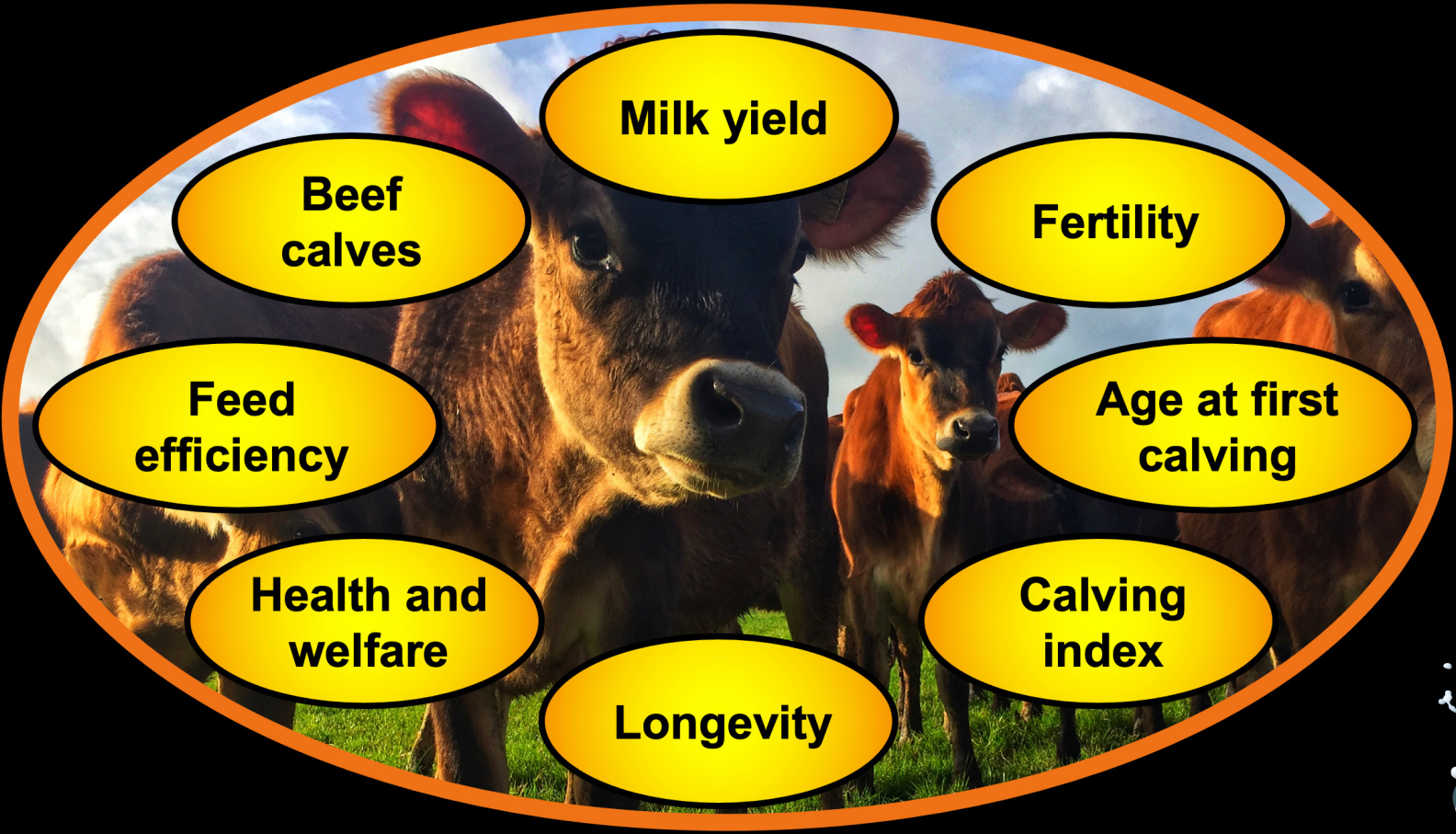


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D

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



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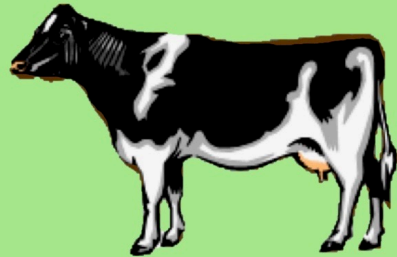


Source: Created by Dr. Jude L. Capper, 2021

DS

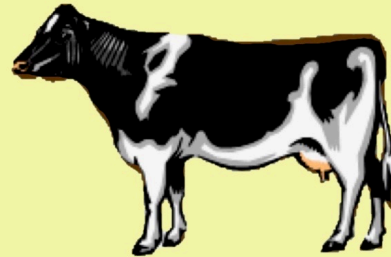
Dairy heifer losses are significant in UK herds

Birth



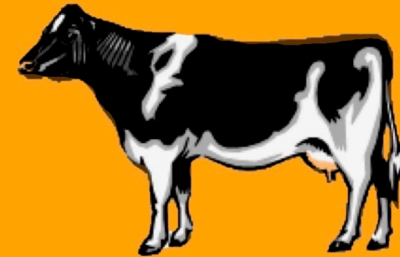
**100 heifers
are born**

Calving



**81 heifers
enter herd**

100 d lactation



**77 survive
past 100 days**

**Each heifer requires 6,118 kg feed DM to rear it
from birth to calving**

Source: Created by Dr. Jude L. Capper, 2017. Data from Wathes et al. (2008) Factors affecting heifer survival and fertility on commercial dairy farms. *Animal*; Hanks and Kossaibati (2016) Key performance indicators for the UK national dairy herd. University of Reading, Reading, UK.

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DS

Does big = bad? Are welfare and GHG emissions linked?



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Source: Created by Dr. Jude L. Capper, 2021. Photo credit: Neil Baker, Bakers of Haselbury Plucknett.



B

Sustainability indices may be increasingly present on dairy labels in future

Dairy cheese (animal-based)

Nutritional value*

Serving size: 50 g (1.8 oz) cheese

78%

Pure dairy milk – contains no lab-based ingredients!

Sustainability index



Carbon footprint (under GWP*)



Water footprint



Antibiotic footprint



Community support rating



Farm webcam and sustainability assessment data



*compared to ideal protein



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Source: Created by Dr. Jude L. Capper, 2021.

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AH

Disease losses are significant and preventable, but the sustainability impacts aren't quantified



Lost: 20%

Harvested: 80%

At the worldwide level, average losses due to animal diseases are more than 20% (OIE, 2008)



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Source: Created by Dr. Jude L. Capper, 2020. Data from: World Organization for Animal Health. 2008. <http://www.oie.int/for-the-media/editorials/detail/article/feeding-the-world-better-by-controlling-animal-diseases>

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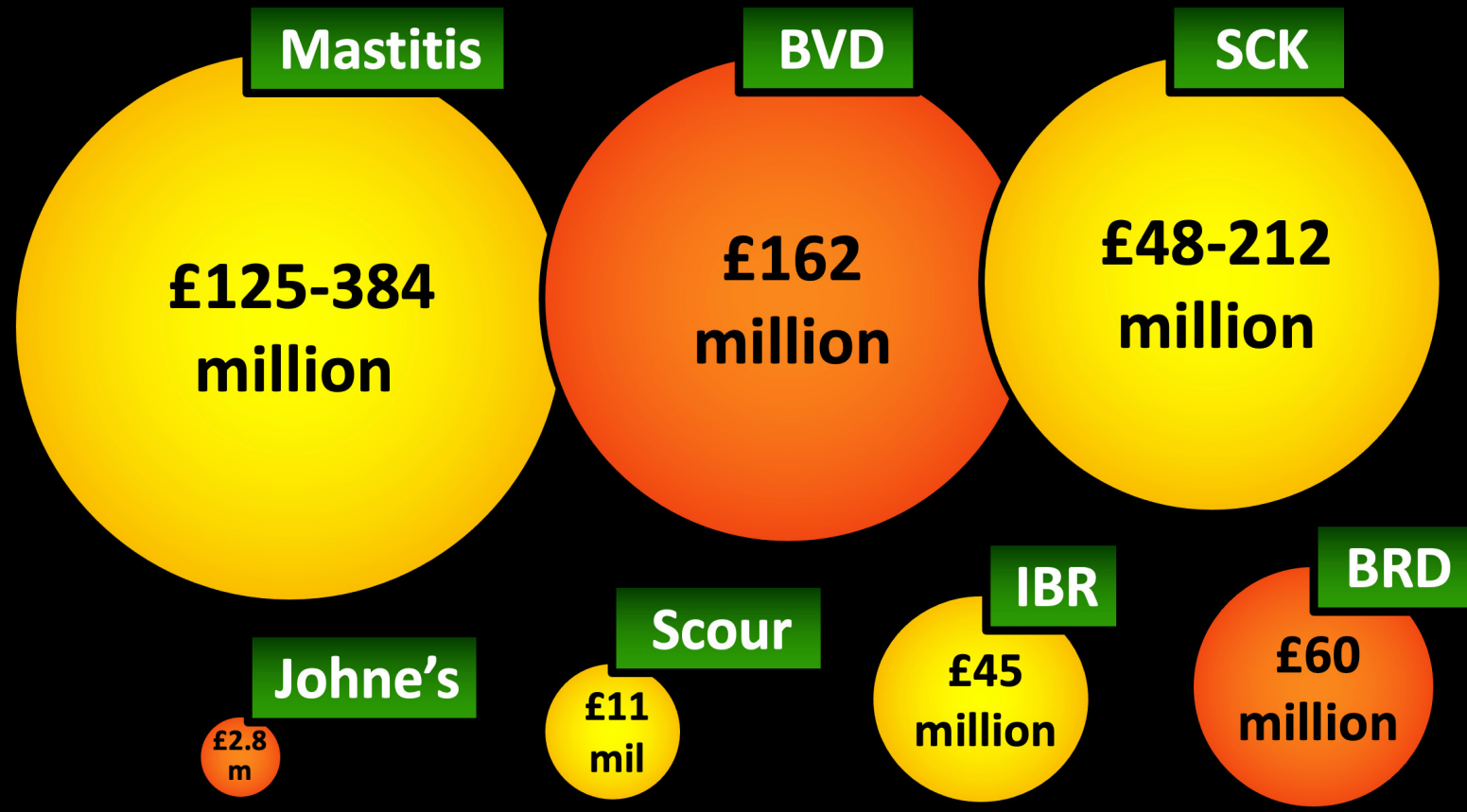
AH

Impacts of disease on economic cost to the UK cattle industry

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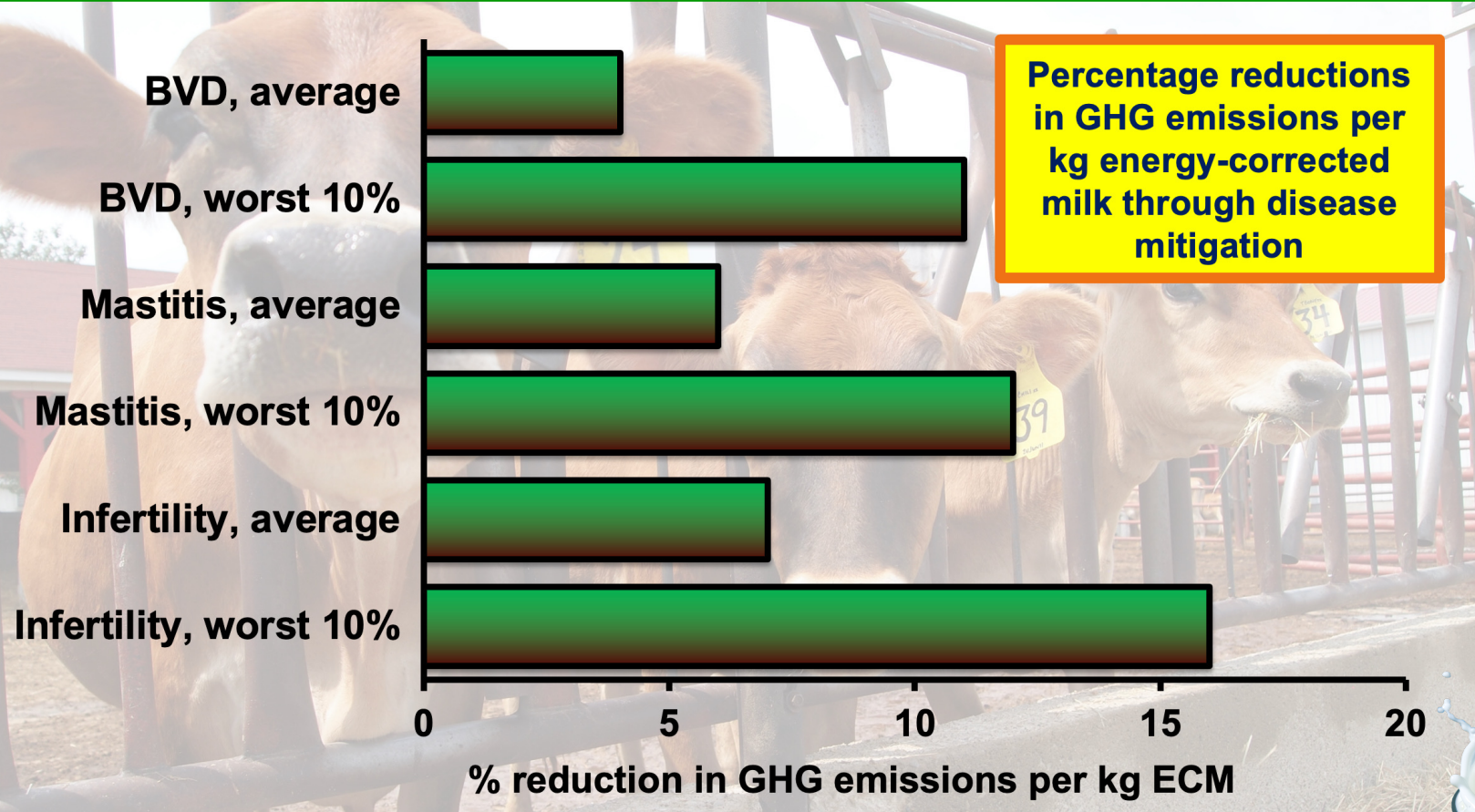
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Source: Created by Dr. Jude L. Capper, 2020. More information available at: <https://www.msd-animal-health-hub.co.uk/TimeToVaccinate>

DS

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



Source: Created by Dr. Jude L. Capper, 2021. 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>

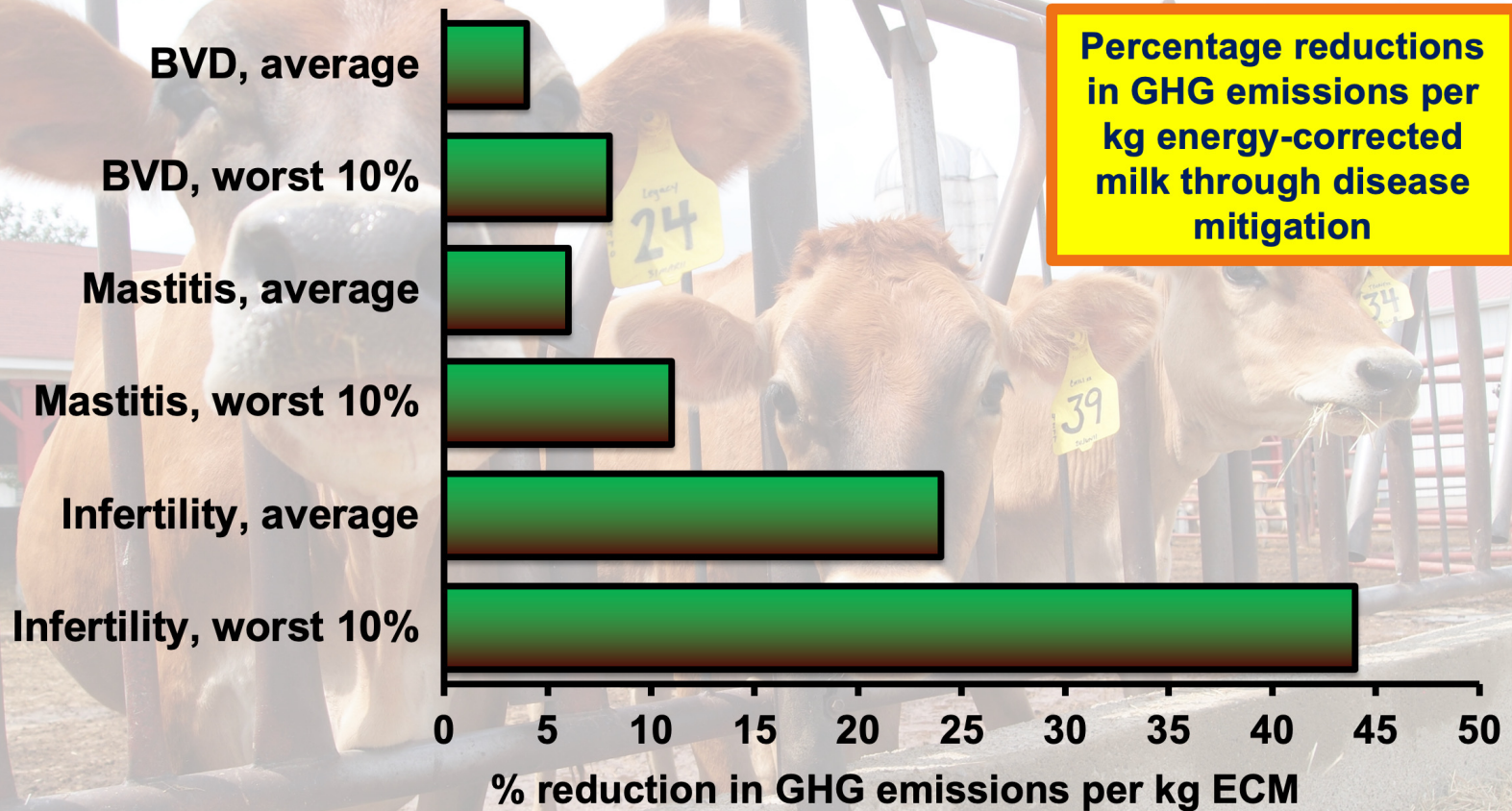
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DS

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



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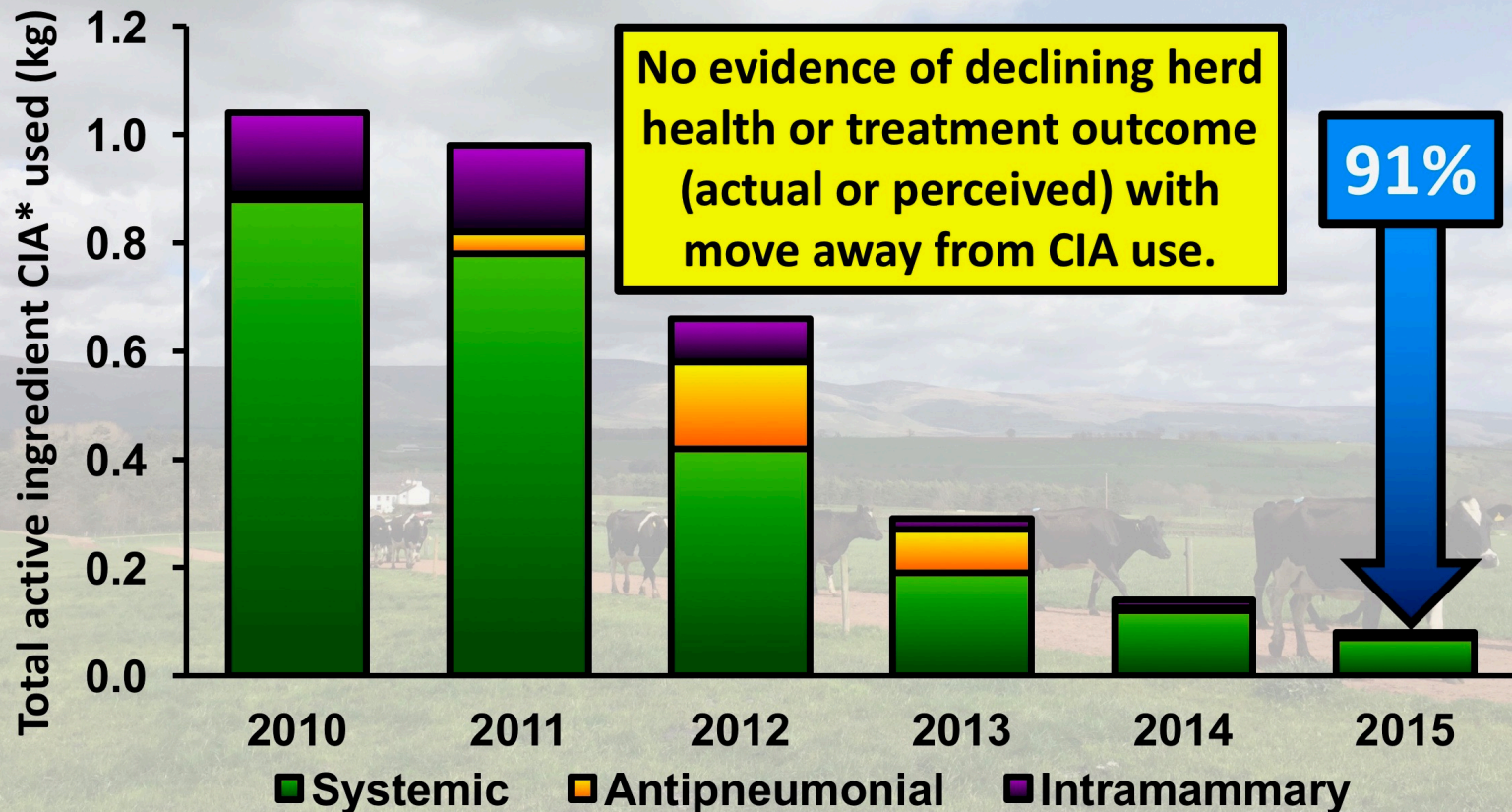
Source: Created by Dr. Jude L. Capper, 2021. Data from: Statham et al. 2021. Dairy Cattle Health and Greenhouse Gas Emissions Pilot Study: Chile, Kenya and the UK. Available from: <https://dairysustainabilityframework.org/wp-content/uploads/2020/10/Dairy-Cattle-Health-and-GHG-Emissions-Pilot-Study-Report.pdf>

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AMR

Case study: critically-important antibiotics* phased out successfully over time



Source: Created by Dr. Jude L. Capper, 2017. Data from: Tisdall et al. (2017) Achieving responsible medicines use at practice and farm level. *In-Practice*. Antimicrobial reduction achieved by Langford Farm Animal Practice between 2010 and 2015 despite 10% increase in dairy cattle numbers. 91% decrease in systemic use, 100% in intramammary use, 82% reduction overall. *Defined as third- and fourth-generation cephalosporins, fluoroquinolones and long-acting macrolides

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



Annual milk yield

4,500
kg

Milk lost if cow dies

8,537
kg

Meat lost if cow dies

430
kg CW

Extra GHG emissions

3,751
kg
CO₂e

Source: Created by Dr. Jude L. Capper, 2021. 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 CO₂e GHG emissions per heifer/yr.

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Thank you!

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http://bovidiva.com/presentationlinks

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Questions?



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Source: Created by Dr. Jude L. Capper, 2020. Cartoon from: <http://RubesCartoons.com>