

Sustainability in smallholder farming in Africa

Prof. Jude Capper
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Prof. Jude L. Capper

3rd November 2021

Source: Dr. Jude L. Capper, 2021

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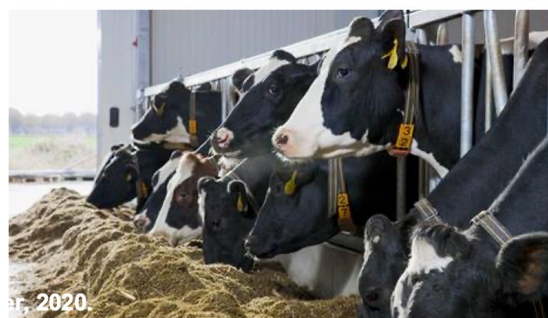
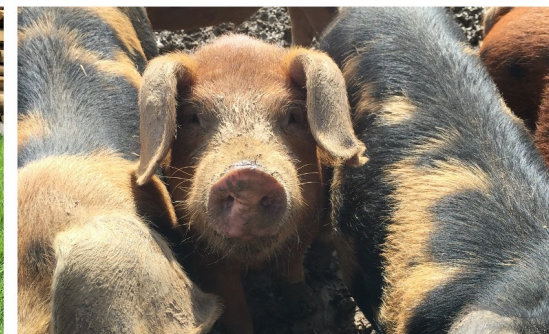
There is no definitive sustainable protein system – but every system can be sustainable

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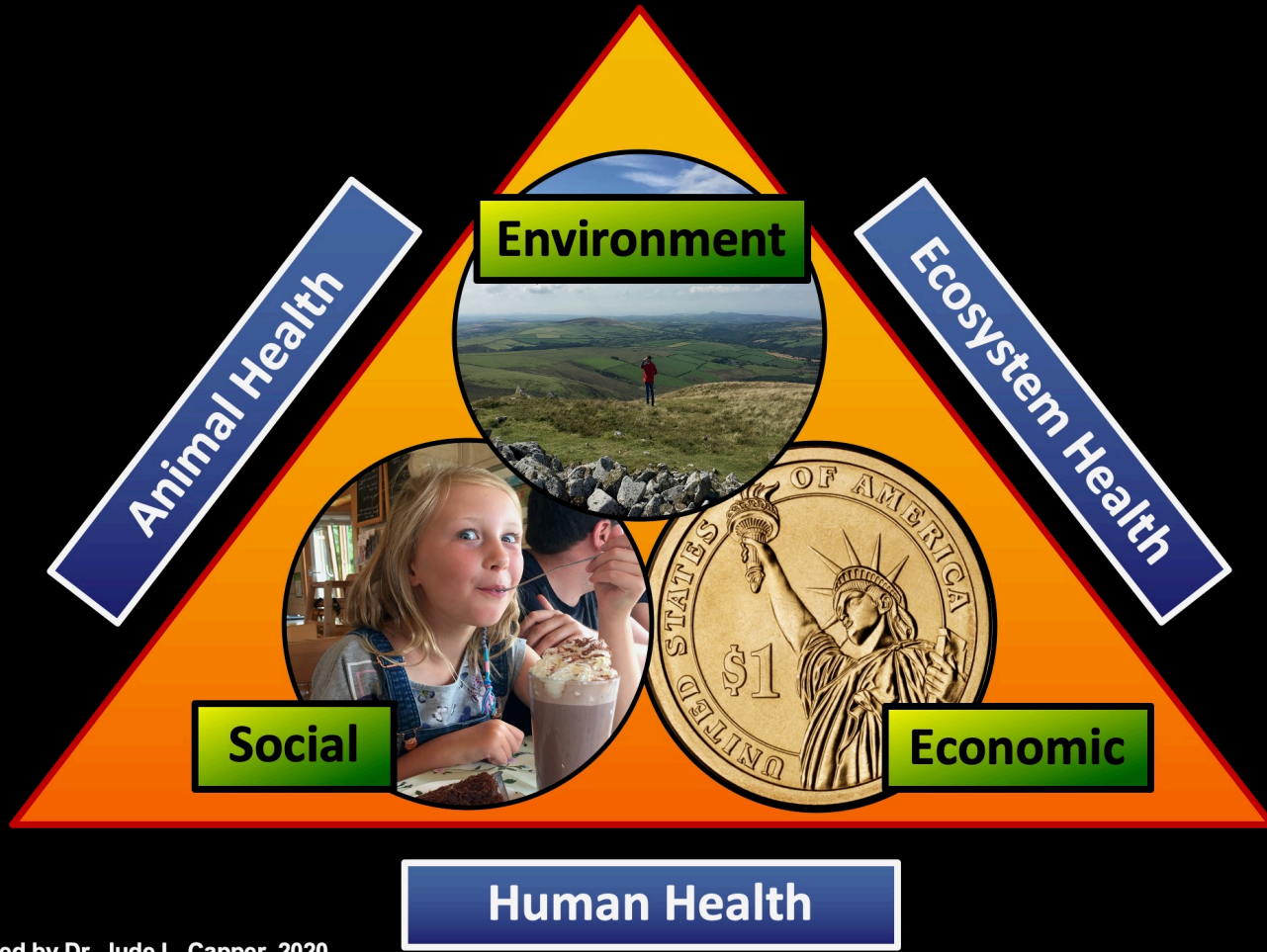
Source: Created and photos by Dr. Jude L. Capper, 2020

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



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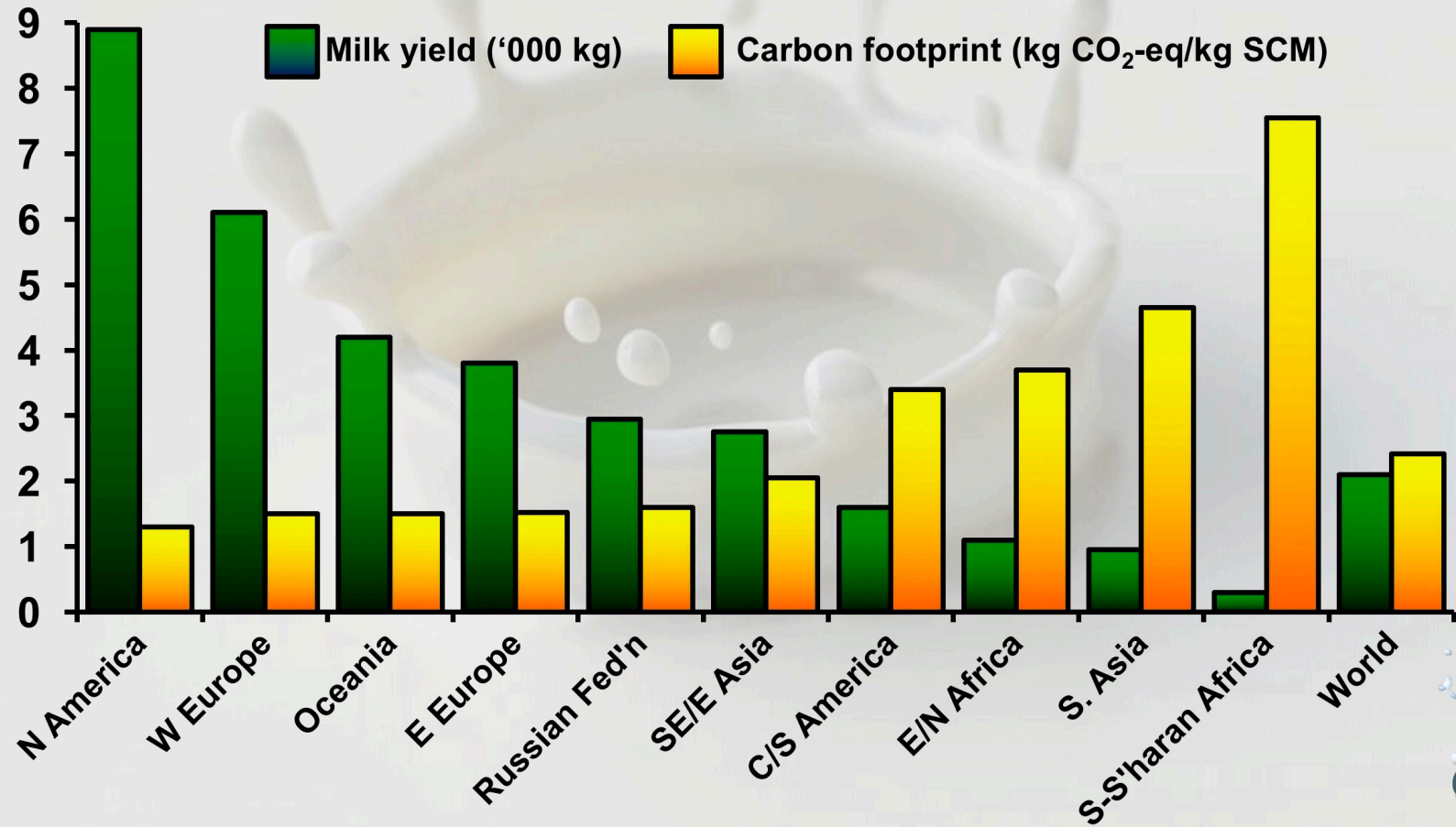
Source: Created by Dr. Jude L. Capper, 2020.

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A negative correlation exists between milk yield and carbon emissions



Source: Created by Dr. Jude L. Capper, 2016; data from: FAO (2010) Greenhouse Gas Emissions from the Dairy Sector. FAO, Rome, Italy.

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What could global dairying look like if we improved health, nutrition and genetics?

Global average yield

2,577
kg

UK average yield

8,140
kg

Dairy cows

-181
million

If all dairy cattle had UK yields, global milk supply could be maintained using 181 million fewer cows (69%).

At US average yields, 200 million fewer cows (75%)

Source: Created by Dr. Jude L. Capper, 2020. Data from: FAOSTAT (2020) <http://www.fao.org/faostat/en/>

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Jersey vs. Holstein: Summary of breed characteristics

	Holstein	Jersey
Daily Milk Yield (kg)	29.1	20.9
Fat %	3.8	4.8
Protein %	3.1	3.7
<i>Cheese Yield (%)</i>	10.1	12.5
Calving Interval (mo)	14.1	13.7
Annual Turnover %	34.5	30.0
<i>Expected # Lactations</i>	2.54	3.00
Age @ First Calving (mo)	26.1	25.3
<i>Heifer: Cow Ratio</i>	0.86	0.83
Mature Cow Body Weight (kg)	680	454

Source: Created by Dr. Jude L. Capper, 2021. Adapted from Capper, J. L. and R. A. Cady (2012). A comparison of the environmental impact of Jersey vs. Holstein milk for cheese production. *J. Dairy Sci.*

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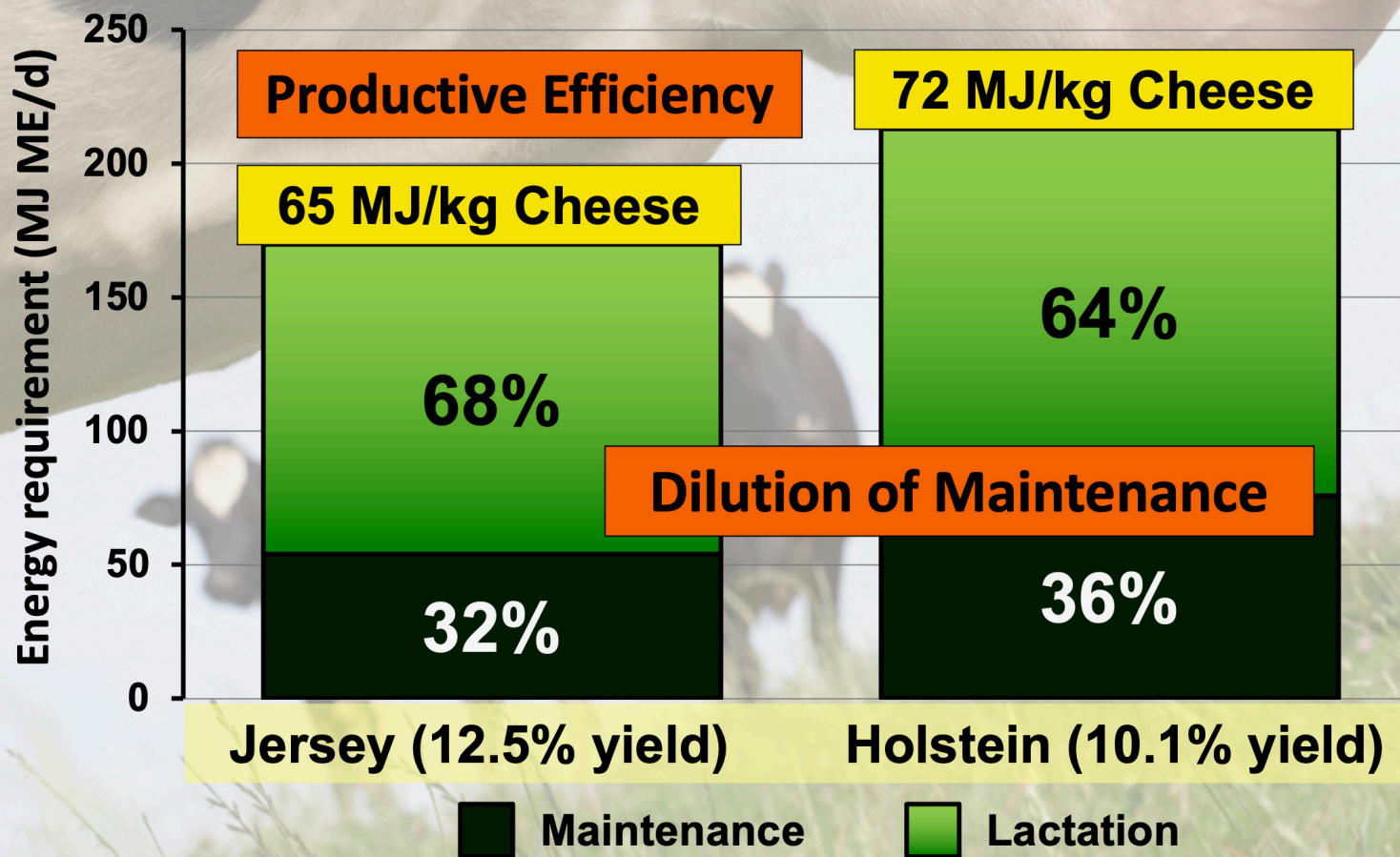


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Both the reduction and dilution of maintenance reduce energy use per unit of cheese



Source: Created as an example by Dr. Jude L. Capper, 2021; Based on nutrient requirements for a 681 kg Holstein cow (29.1 kg milk, 3.8% fat, 3.1% protein) and 454 kg Jersey cow (20.9 kg milk, 4.8% fat, 3.8% protein).

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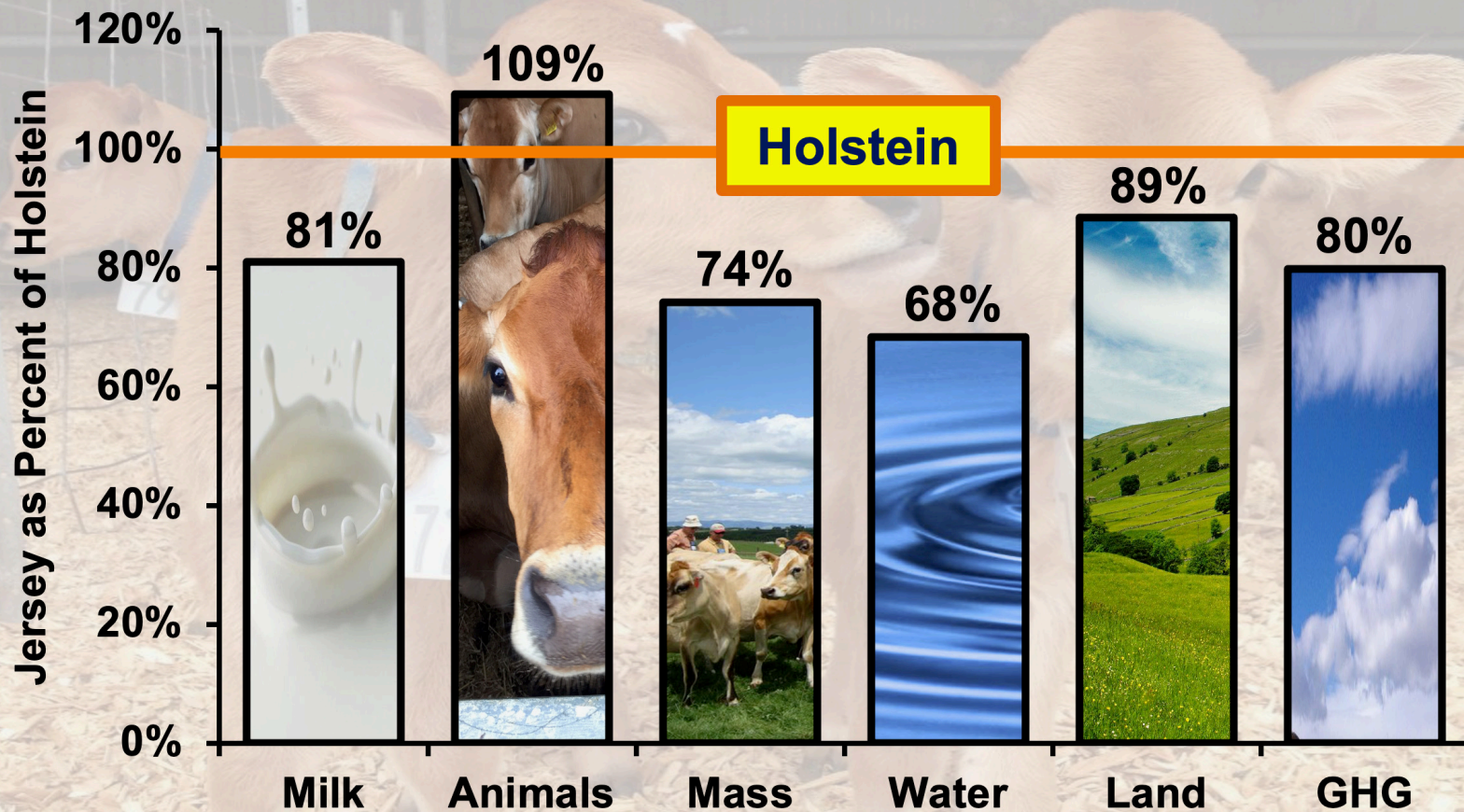


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Jersey vs. Holstein: comparison of resource use and environmental impact



Source: Created by Dr. Jude L. Capper, 2021. Data from Capper, J. L. and R. A. Cady (2012). A comparison of the environmental impact of Jersey vs. Holstein milk for cheese production. *J. Dairy Sci.*

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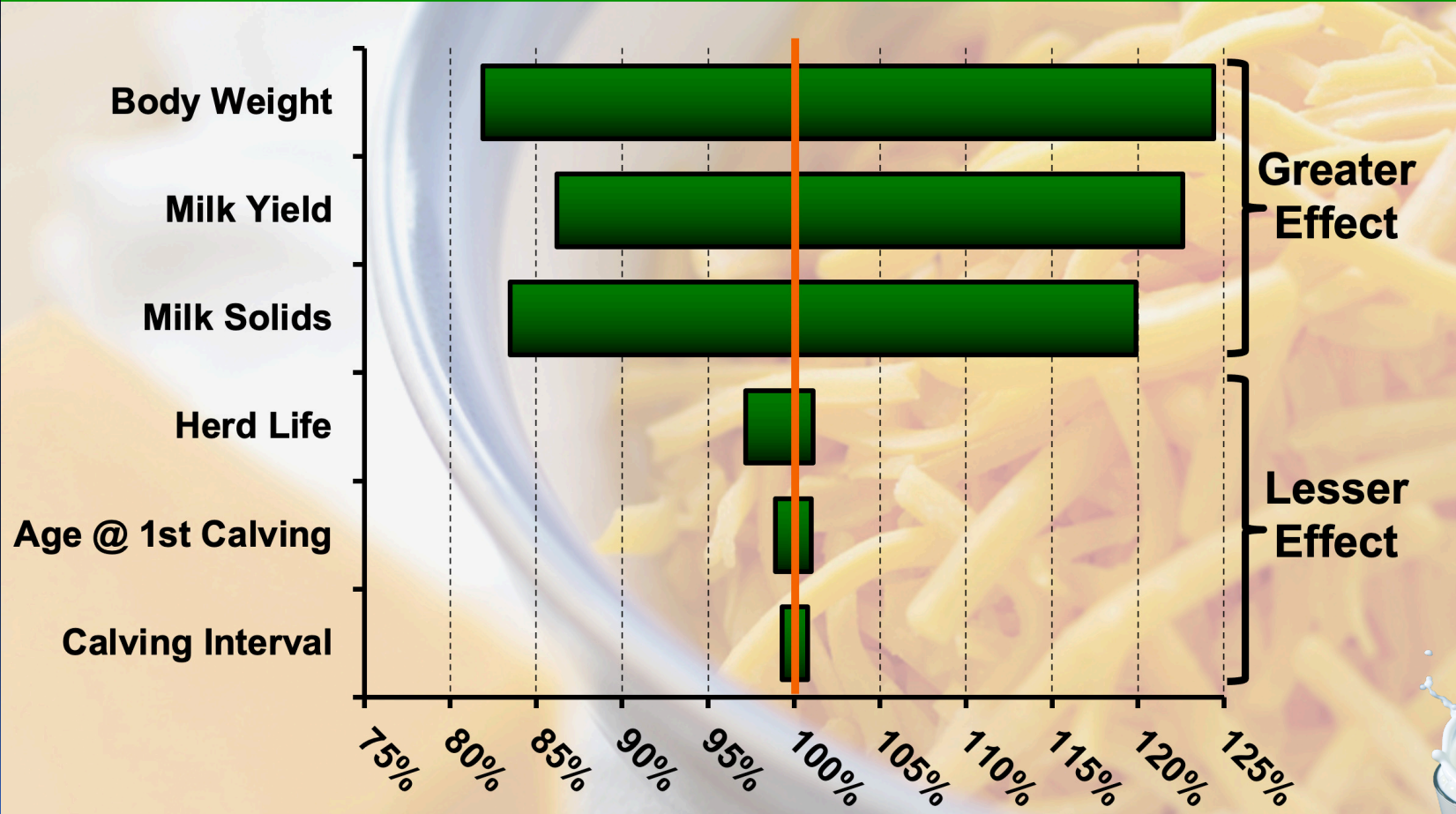




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Effect of cow characteristics on greenhouse gas emissions per unit of cheese



Source: Created by Dr. Jude L. Capper, 2021. Adapted from Capper, J. L. and R. A. Cady (2012). A comparison of the environmental impact of Jersey vs. Holstein milk for cheese production. *J. Dairy Sci.*

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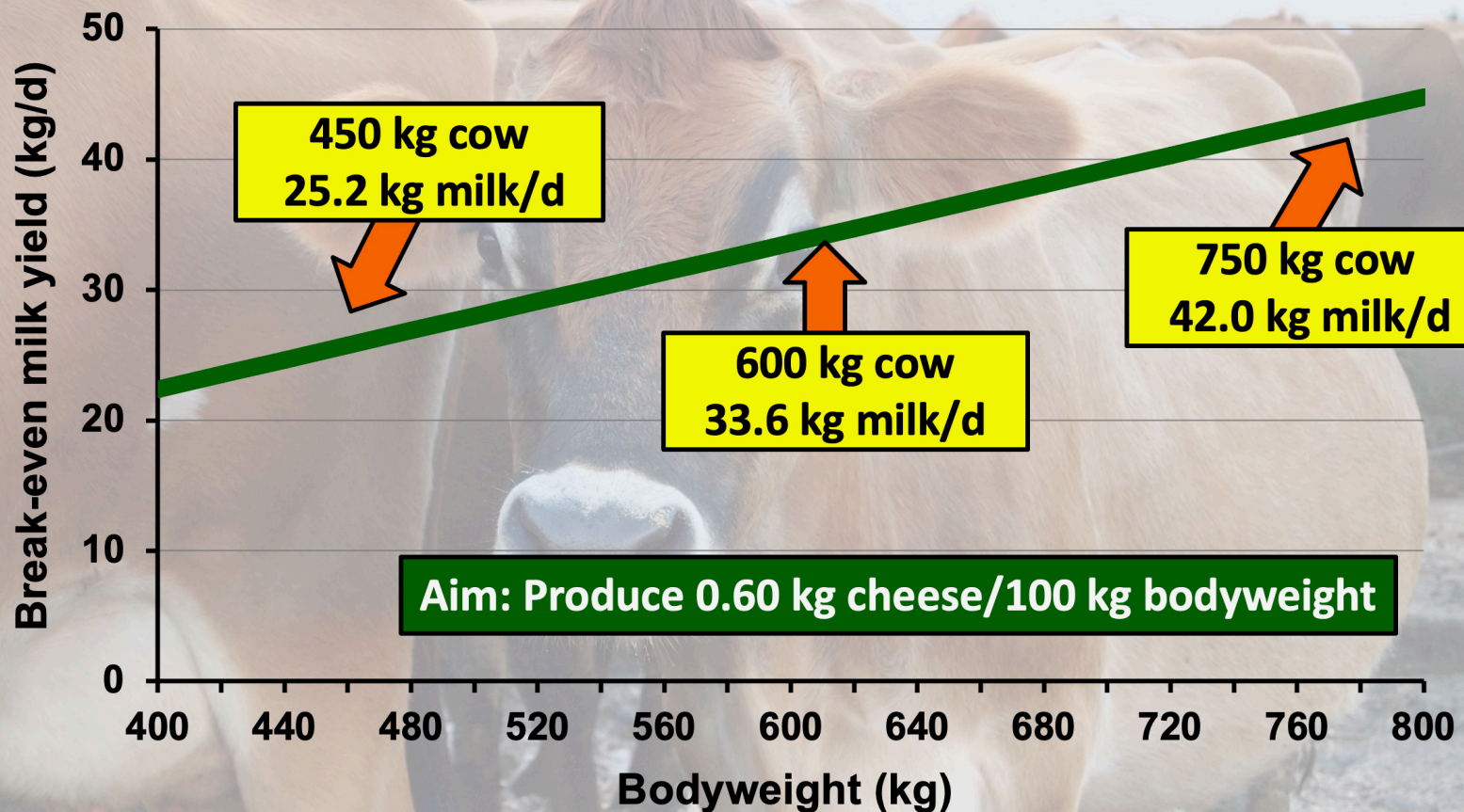
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Output per kg bodyweight: smaller cow yielding less = big cow yielding more



Source: Created by Dr. Jude L. Capper, 2021. Adapted from Capper, J. L. and R. A. Cady (2012). A comparison of the environmental impact of Jersey vs. Holstein milk for cheese production. *J. Dairy Sci*

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Smallholder farms are a crucial component of world agriculture



There are over 570 million smallholder farms worldwide, operating on 12% of global farmland.

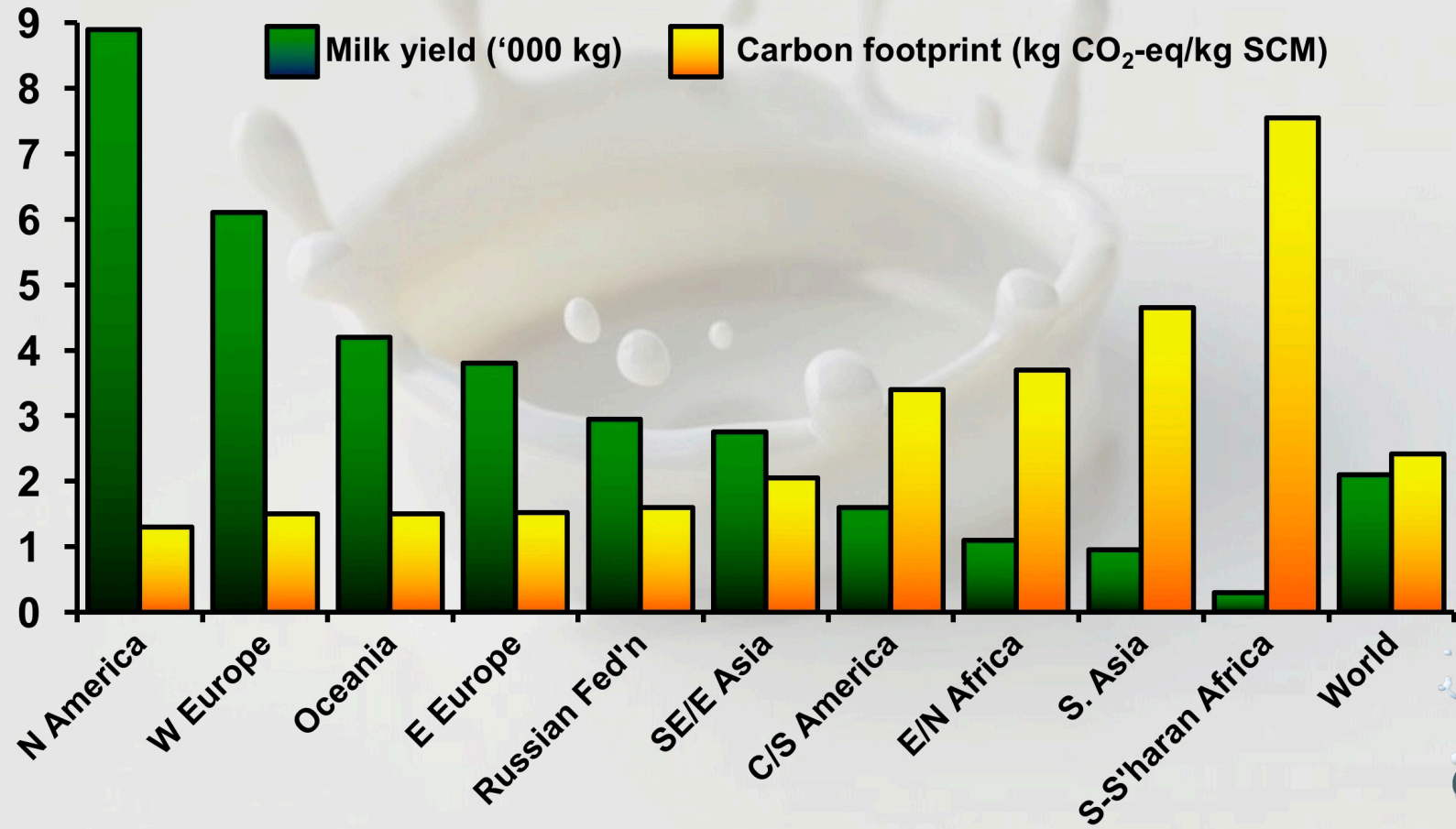
Source: Created by Dr. Jude L. Capper, 2021. Data from: Lowder et al. 2016. *World Dev* 87. Photo source: Ibrahim El-Mezayen, CC BY-SA 4.0 <<https://creativecommons.org/licenses/by-sa/4.0/>>, via Wikimedia Commons.

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A negative correlation exists between milk yield and carbon emissions



Source: Created by Dr. Jude L. Capper, 2016; data from: FAO (2010) Greenhouse Gas Emissions from the Dairy Sector. FAO, Rome, Italy.

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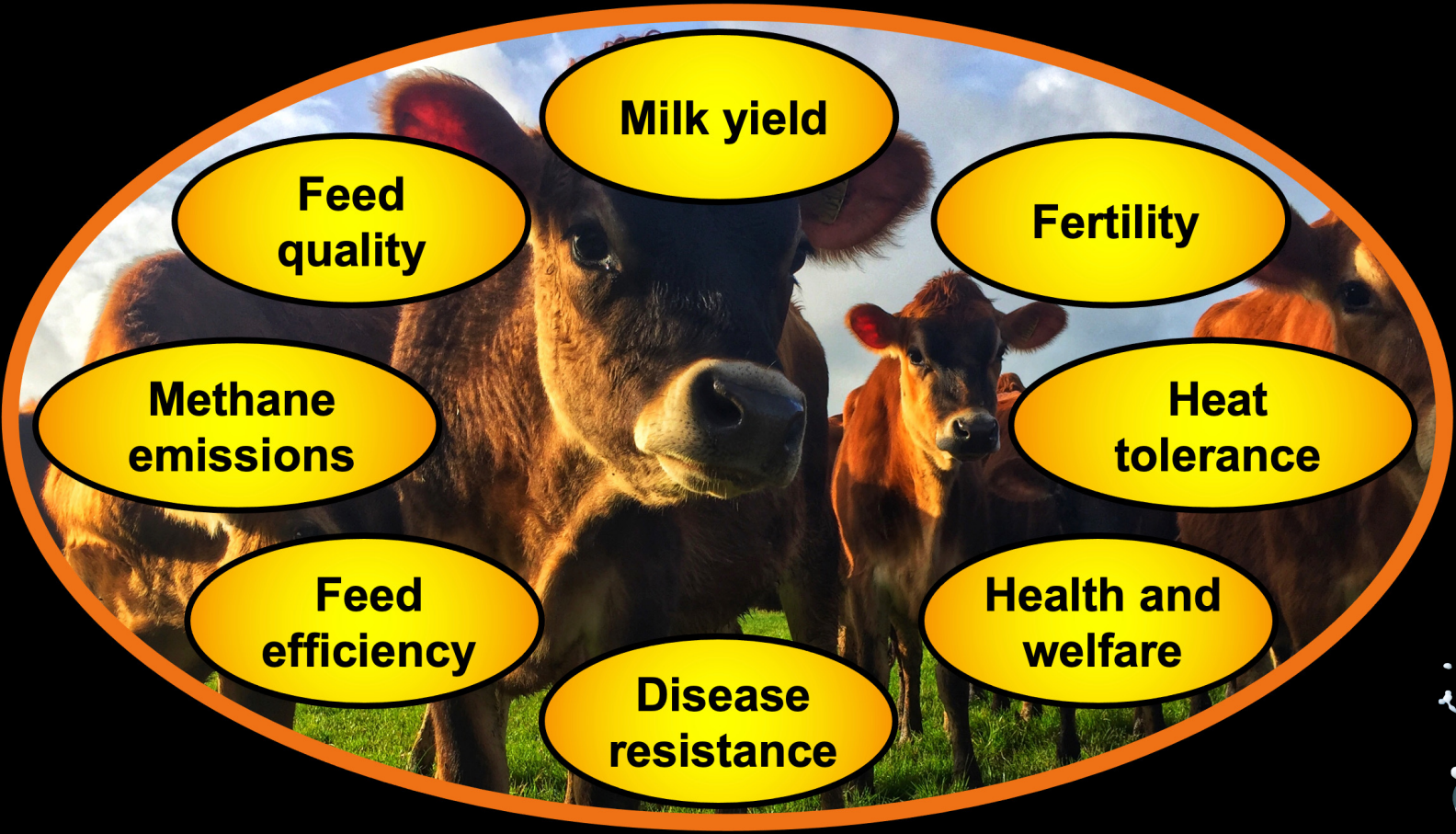


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Multiple opportunities exist for smallholders to reduce GHG emissions



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

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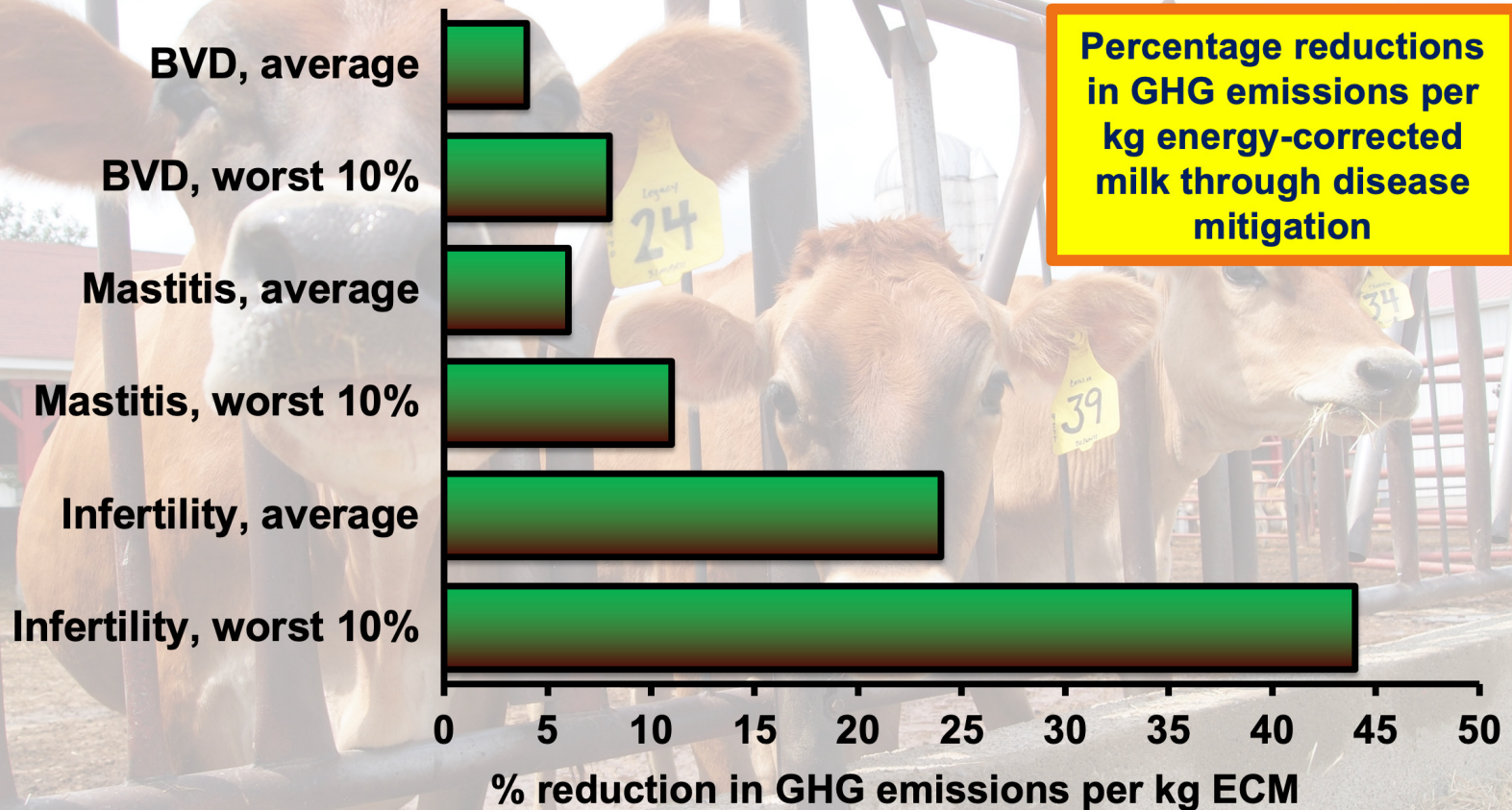
Source: Created by Dr. Jude L. Capper, 2020. Data from: World Organization for Animal Health. 2008. <http://www.oie.int/for-the-media/editorials/detail/article/feeding-the-world-better-by-controlling-animal-diseases>



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



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



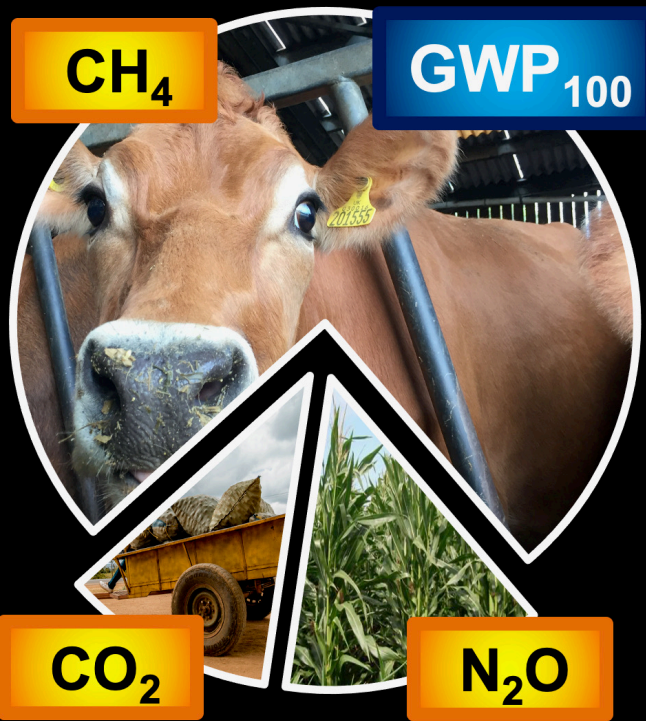
Source: Created by Dr. Jude L. Capper, 2021. Calculated as an example based on a 4,500 kg annual milk yield, 26 mo age at first calving, 14 mo calving interval, 248 kg carcass weight, 0.69 live calves born/yr, 0.50 calves reared for beef, and average of 1,731 kg CO₂e GHG emissions per heifer/yr.

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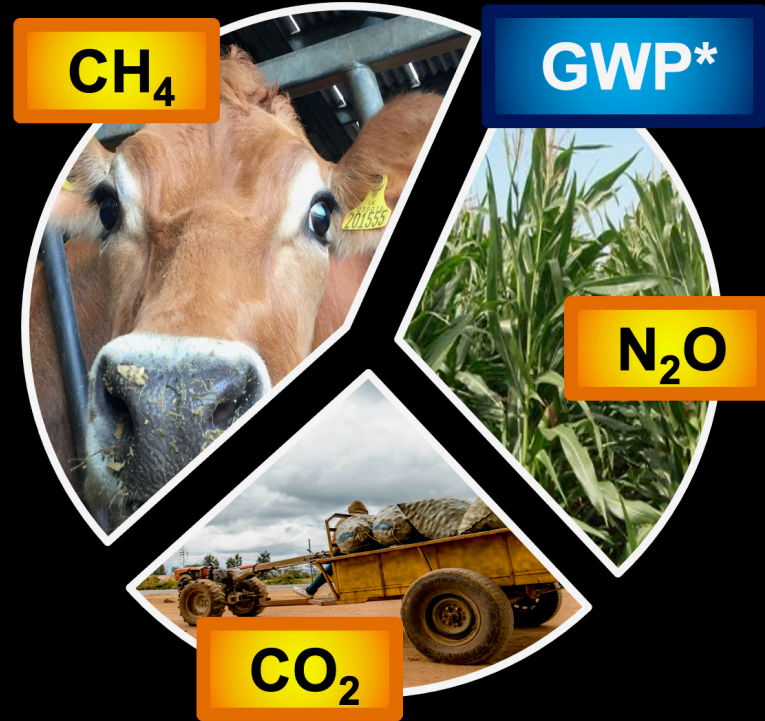


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The carbon footprint of smallholder dairying may be considerably reduced by GWP*



GWP₁₀₀ = 2.30 kg CO₂e/kg FPCM



GWP* = 1.00 kg CO₂e/kg FPCM

Source: Created by Dr. Jude L. Capper, 2021. Calculation based on carbon footprint of smallholder dairy production cited by Garg et al. (2016) Animal Production Science 56.

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



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How do we account for myriad livestock benefits in sustainability metrics?



Nutrition



Income



Fertiliser



Draught power



Cultural status



Education



Female emancipation

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

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You don't have to be the biggest,
you do need to do your best

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



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Thank you!

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Questions?



Source: Created by Dr. Jude L. Capper, 2021. Cartoon from: <http://RubesCartoons.com>