A holistic approach to sustainability from calf to 5th lactation and beyond

Dairy NutriVision, 12th September 2024

Dr Liz Homer, Sustainability Manager Ruminants ECA

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About me

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2. What can we do today to reduce carbon footprint?
3. …and **HOW** can we achieve this?
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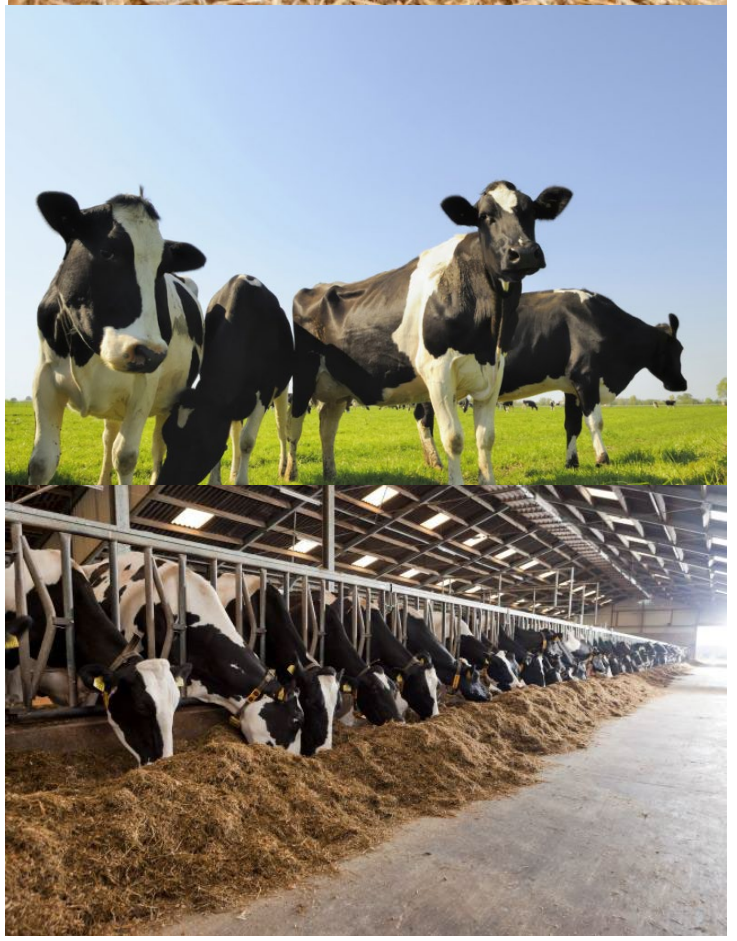
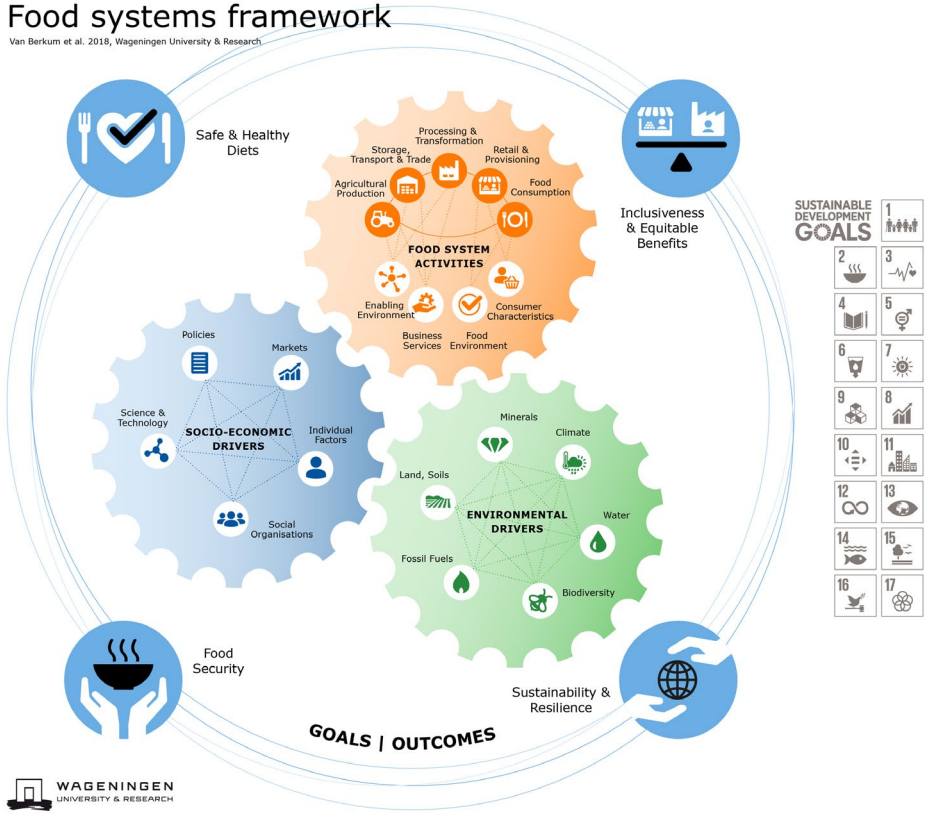


Why do we need to be more sustainable?

- Green Deal
- Sustainable Food System Framework
- Farm to Fork Strategy
- Corporate Sustainability Reporting Directive
- Green claim initiative
- EU Deforestation Regulation
- **…and many others to comply with now and in the near future**



SCIENCE BASED TARGETS

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No one system is most sustainable...

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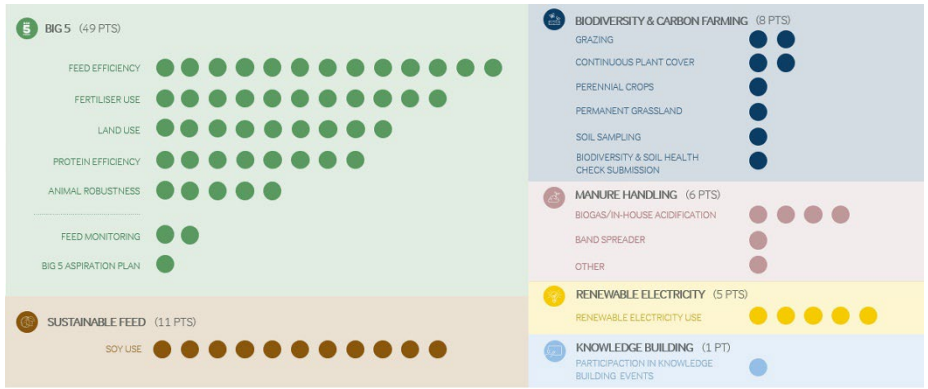
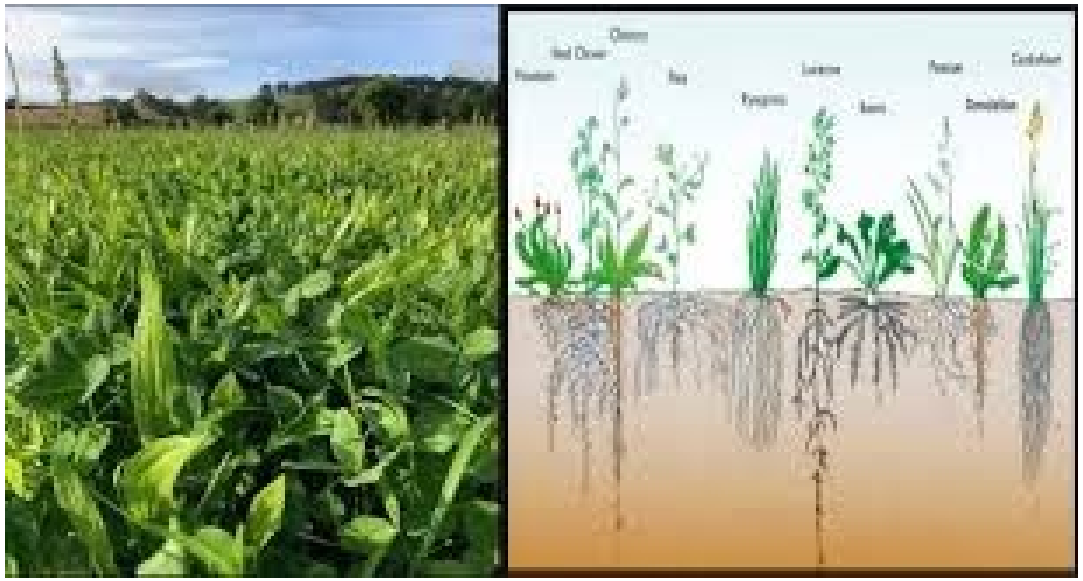
Challenges facing dairy farmers





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What can we do today?

CALF
Epigenetics

Unlocking genetic potential

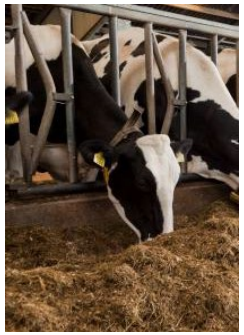
HEIFER
Development

Age at first calving 22-24 months

TRANSITION
Resilience

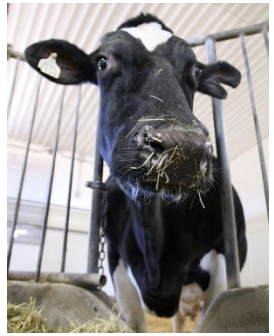
Reduced incidence of challenge

MILKING COW
Productivity



Sustained peak yield at 50-70 DIM

LACTATIONS
Longevity



Complete a healthy 5th lactation

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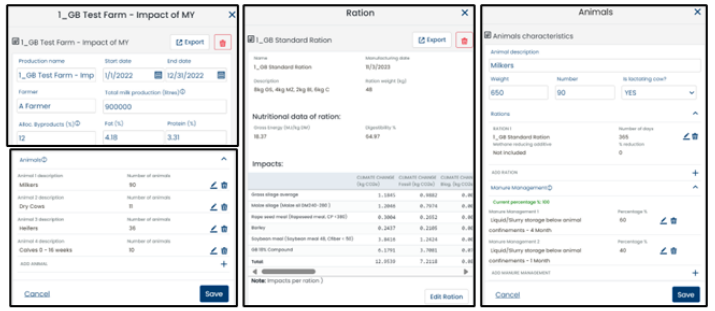
Process of environmental footprinting



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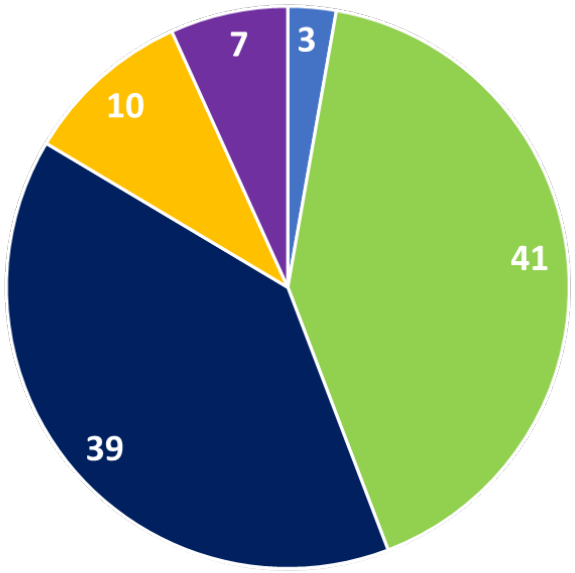
What makes up the carbon footprint per kg FPCM?



1. **Energy**
2. **Feed**
3. **Nitrous Oxide**
4. **Manure management**
5. **Enteric fermentation**

1. Diet that the animals eat
2. Purchased feeds
3. Formulation of the diet
4. Number of animals eating that diet
5. Efficiency of those animals to convert feed into milk

Source: Trouw Nutrition MilkPrint

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It all starts with youngstock...

Goal	Stages		Target
Optimise Lifetime Daily Yield	Calf	0-16 weeks	**EPIGENETICS** Unlocking genetic potential
	Heifer	16 weeks to 6 weeks pre-calving	**DEVELOPMENT** Age at First Calving 22-24 months
	Transition	Dry cow to calving	**RESILIENCE** Reduced incidence of challenge
	Milking cow	Early lactation to 305 days	**PRODUCTIVITY** Sustained peak yield reached at 50-70 DIM
	Multiple lactations 5	5th lactation	**LONGEVITY** Complete a healthy 5th lactation with minimal interventions

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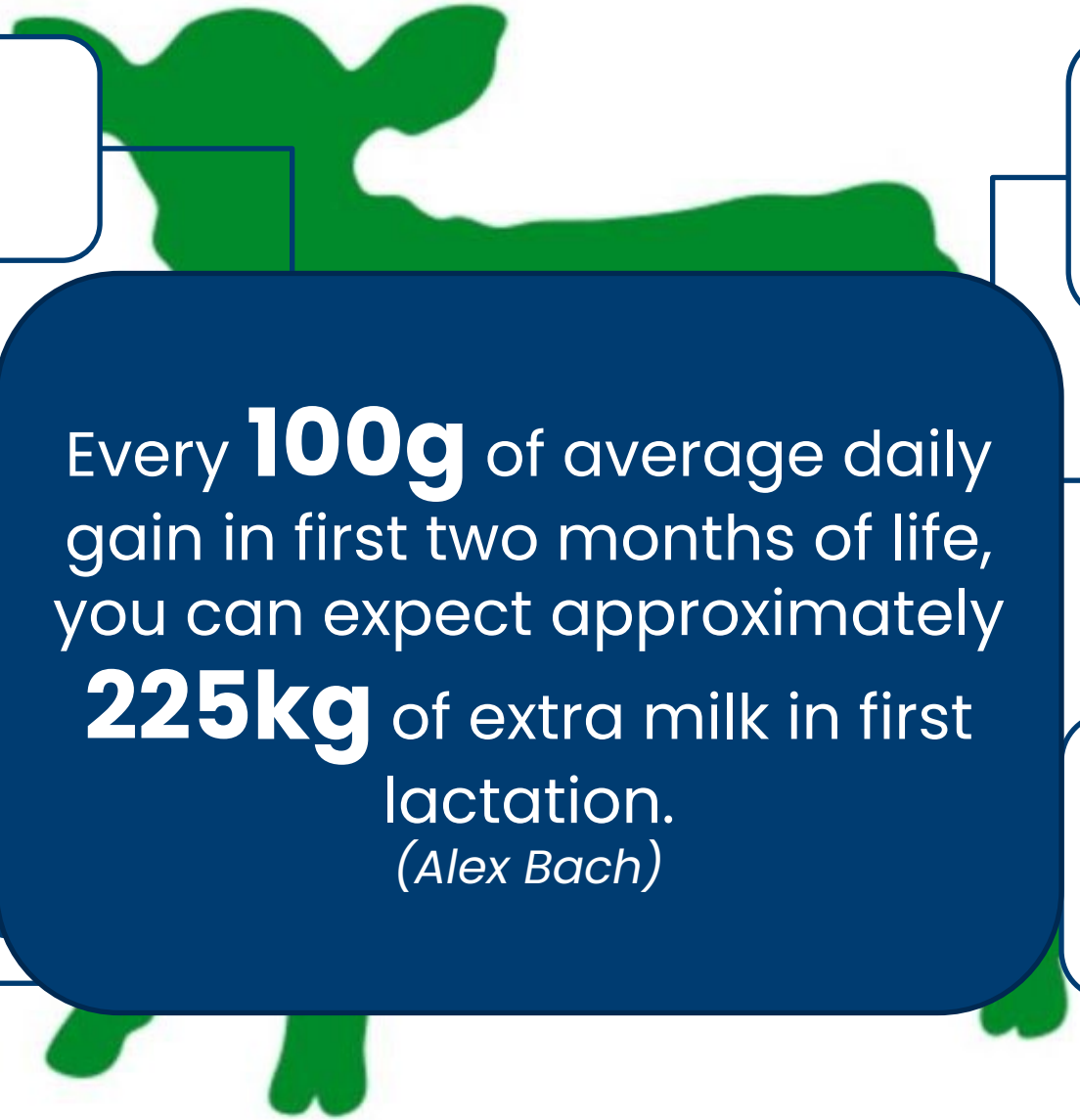

Pancreas

↑ Cell cycle
↑ Function Langerhans islets
↑ Insulin secretory capacity

Liver

↑ Cell cycle
↓ Branched chain amino acids
↓ Synthesis of lipids/lipoproteins

Bone marrow

↓ Cell cycle
↓ Inflammation
↑ Metabolism of lipids and lipoprot

Every **100g** of average daily gain in first two months of life, you can expect approximately **225kg** of extra milk in first lactation.
(Alex Bach)

Muscle

↑ Cell cycle
↑ Biosynthesis cholesterol
↓ Oxidative muscle phenotype

Fat

↑ Adipocyte differentiation
↑ Brown like adipocytes
↑ Oxidative metabolism
↓ Inflammation

Mammary gland

↑ Cell proliferation
↑ Triglyceride biosynthesis
↓ Apoptosis

Leal et al., 2016, 2017, 2018; Romão et al., 2018; Hare et al., 2019

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Impact of AFC

6%

AFC, months	28	26	24	22
Milking cows	100	100	100	100
Replacements	65	57	50	43
Calves	19	17	15	14
Total Animals	184	174	165	157
Total Youngstock	84	74	65	57
		£32,000		

6% reduction

GLEAM Herd Dynamics, McLeod et al (2018); Trouw Nutriton MyMilkPrint

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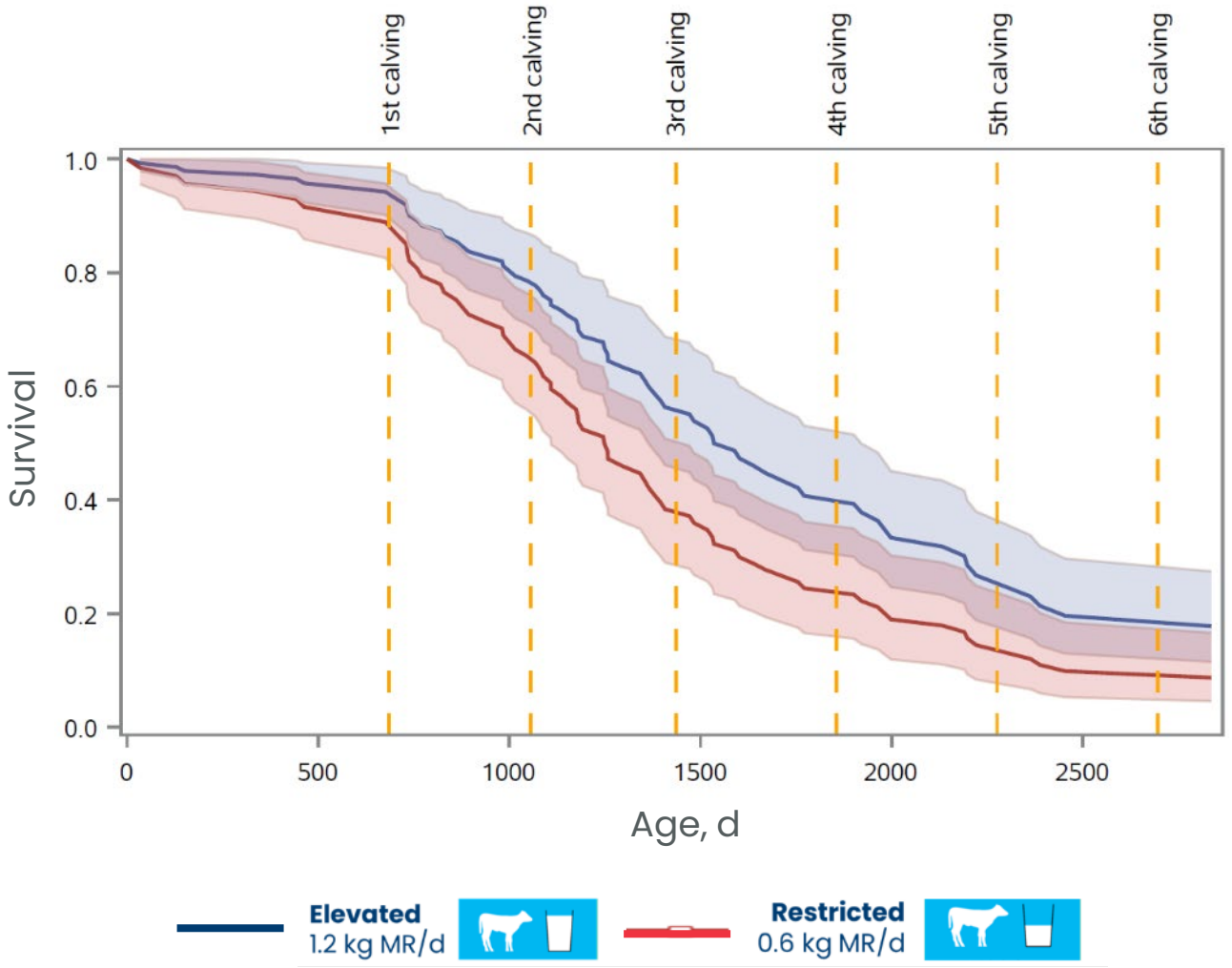
Animals will survive for longer



+300 days

TN R&D; Leal et al., unpublished

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Impact of Replacement Rate

RR, %	40	33	25	20
Av Lact No.	2.5	3	4	5
Milking cows	100	100	100	100
1st Lactation	30	26	21	18
2nd Lactation +	70	74	79	82
Youngstock	72	59	45	36
Calves	14	13	11	10
Total Animals	186	172	156	146
			£72,000	

5%

5% reduction

GLEAM Herd Dynamics, McLeod et al (2018); Trouw Nutrition MyMilkPrint

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HealthyLife and surviving to next lactation

- Culling rates in first 100 DIM
- Effect of **survival** just shown → 5% reduction in footprint
- Mastitis, lameness, fertility, heat stress, poor milk yield, metabolic disease (Yanga *et al.*, 2022)

Country	Culling Rate, %	Replacement Rate, %
UK	28	33
N. Ireland	25	33
Ireland	5-10	23
Netherlands	-	28
Italy	-	40
Germany	25	40

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How to get to the next lactation?

- Post calving drink studies
- Increase in milk yield (+1.5kg/d) and milk protein (+57g/d)
- Effect more pronounced in primiparous animals
- Model in MyMilkPrint based on study data shows a reduction in carbon footprint of approx. 2%

J. Dairy Sci. 104
https://doi.org/10.3168/jds.2020-19742

Effect of a calcium-energy supplement drink at ca... lactation performance: Milk yield and composition, odds to ... a next lactation, and calving interval

Jean-Baptiste Daniel,*† Juliette N. Wilms,* Jan H. Mica, and Javier Martín-Tereso
Trouw Nutrition R&D, P.O. Box 299, 3800 AG, Amersfoort, the Netherlands

Study Information	
Commercial farms	10
# cows	504
Treatment 1	Ca energy supplement
Treatment 2	Placebo

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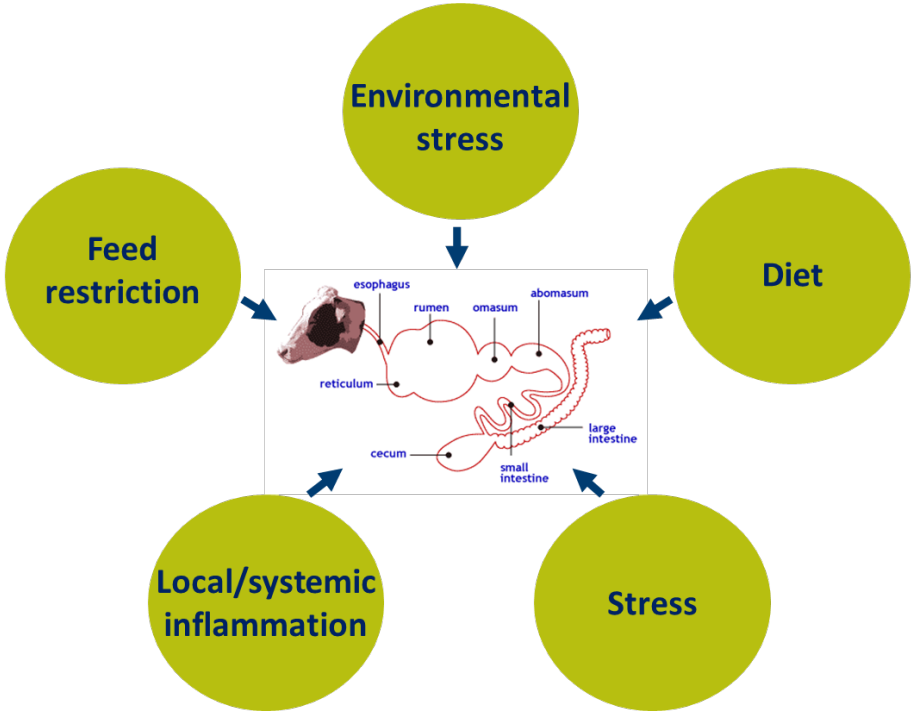
Protecting hindgut particularly in early lactation



~4%

- Post rumen prebiotic improves mil
  - 1.1kg/d in milk yield
  - 0.04% increase in milk protein
- Being proactive can reduce carbon footprint by approx. 4%
- Associated positive effects on fertility → effect on replacement rate

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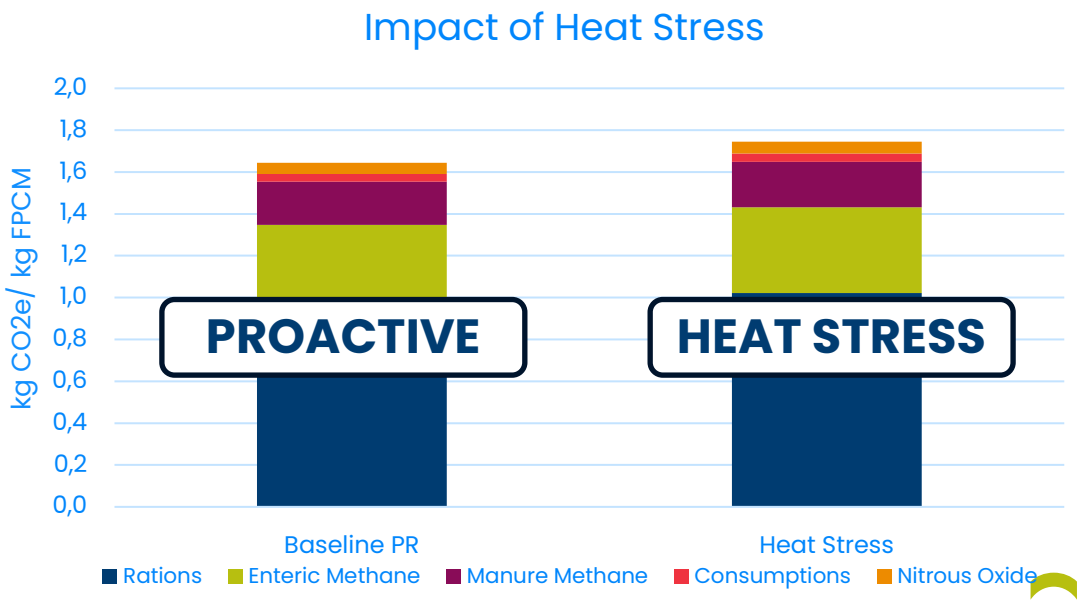
Heat stress scenarios

Italian heat stress data:

- -1.5kg milk per day
- -0.2% butterfat
- -0.1% protein
- -15% conception rate

~6%

Proactive prevention could maintain milk yield, milk constituents and conception rates
→ **profitability** & **carbon footprint!**



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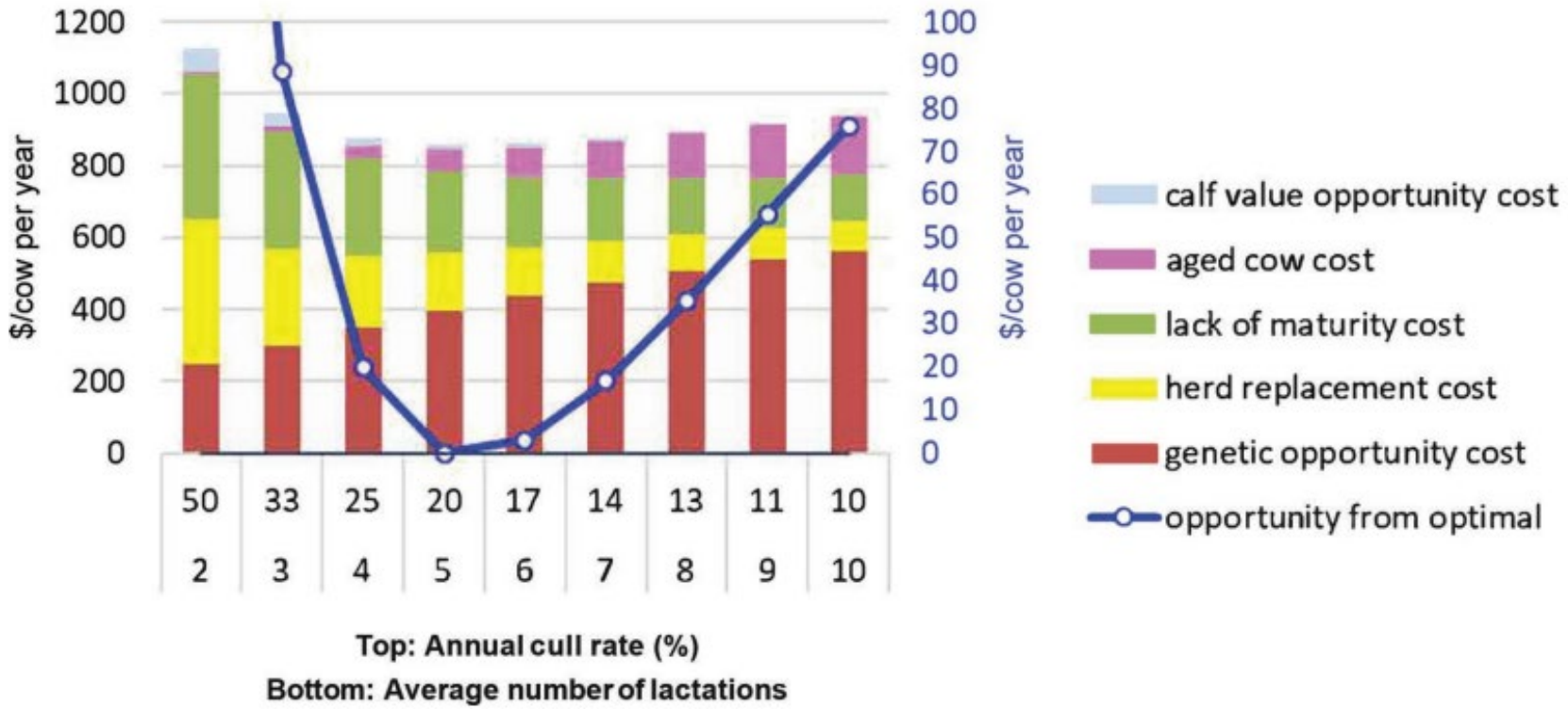
Multiple Lactations – Longevity
Complete a healthy 5th lactation



Top: Annual cull rate (%)
Bottom: Average number of lactations

- 3rd lactation is optimal for genetic expression
- 5th lactation is optimal for minimal aged cow cost
- Low herd replacement at 20% with voluntary culls

De Vries *et al.*, 2020 J. Dairy Sci. 103:3838–3845

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LifeStart & HealthyLife

	Baseline
% reduction in carbon footprint	AFC: 26.4 RR: 30% Milk Yield: 9500
kg CO2e/kg milk	1.20
LDY, kg	12.7
Net value £/ cow	-

Source: Trouw Nutrition MyMilkPrint

LIFESTART
SETS LIFE PERFORMANCE

HEALTHYLIFE
SUSTAINABLE LIFETIME PERFORMANCE

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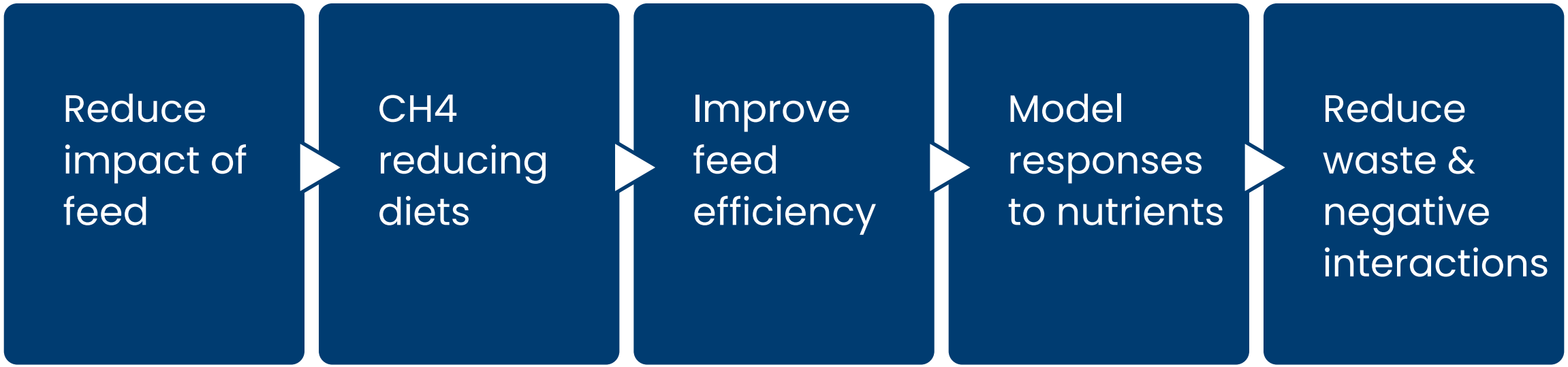
Precision Nutrition



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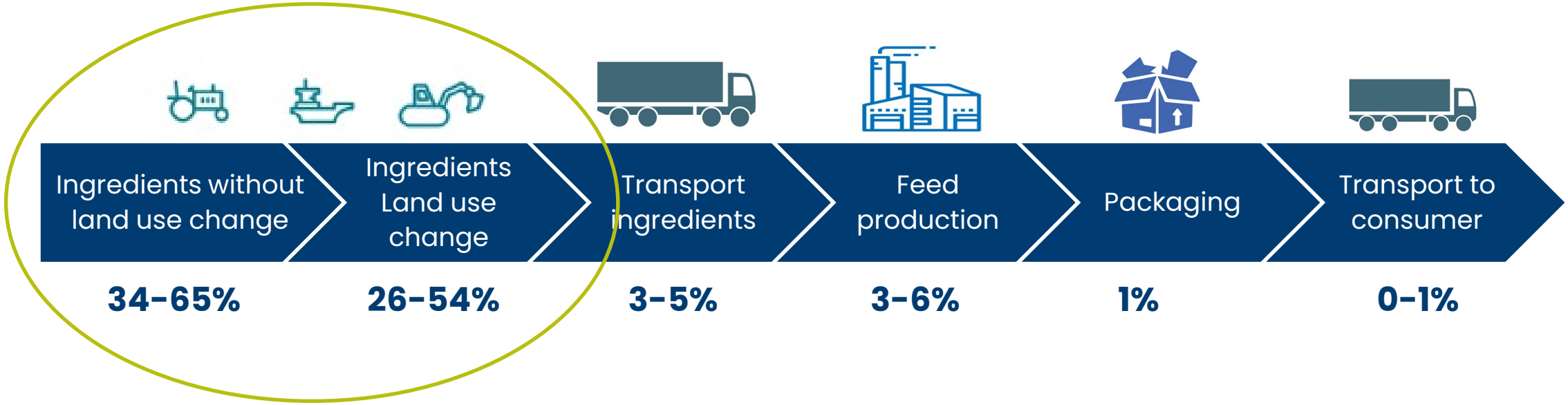
Reducing the impact of feed



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Sourcing of raw materials can have a huge effect

9%

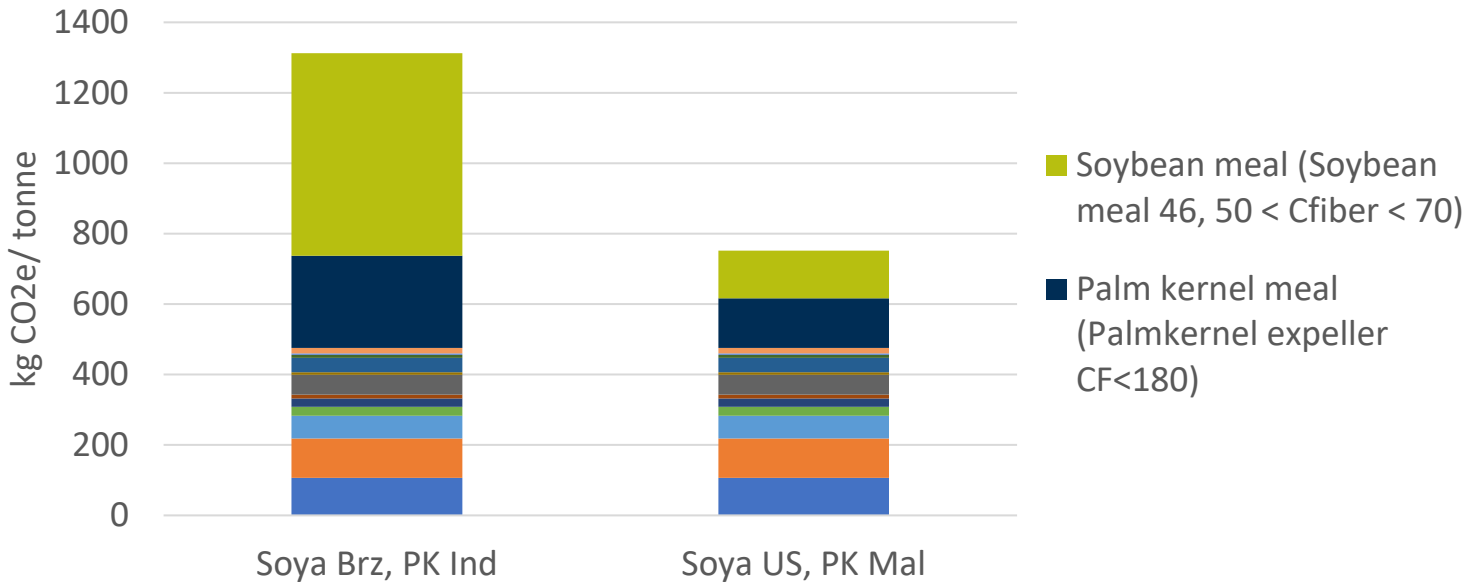
rint

Feed management

+ Add by ingredients + Add by impacts

NAME	ADDITIONAL INFO	MANUFACTURING DATE	CLIMATE CHANGE (kg CO2e)	METHANE (kg)	GWP – LULUC (kg CO2e)	ACIDIFICATION (mol H+e)	AMMONIA (kg)	EUTROP. (WAT.) (kg Pe)
Compound feed 1 Bra/Ind	SBM Brazil, Palm Indonesia	11/9/2022	1312.4069	4.0835	551.8834	7.7448	1.43983	0.15
Compound feed 2 US/Mal	SBM US, Palm Malaysia	11/9/2022	752.1689	3.7697	77.9650	7.7004	1.45262	0.10

Effect of sourcing on footprint of feed



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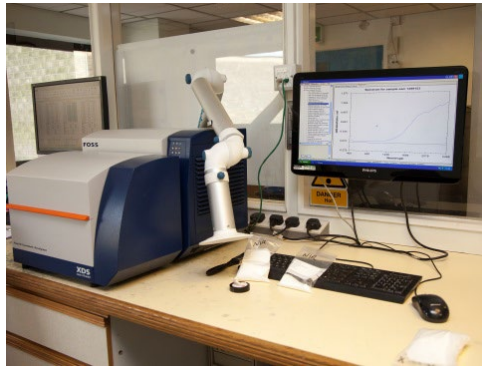
Balancing diets



Forage quality of **to**
bottom 20% forages
byTrouw Nutrition G

3%

Nutrient	Units	High Quality Silage	Lo uality Silage
Dry Matter	%	30.0	40.0
Crude Protein	% DM	16.0	13.9
NDF	% DM	45.5	48.8
D Value	%	72	65
DyNE	MJ/kg DM	6.21	5.52

Good quality silage meant that 2kg DM more could be fed

This meant 1.3kg less compound was fed

Reduce footprint by 3%

Source: Trouw Nutrition MyMilkPrint

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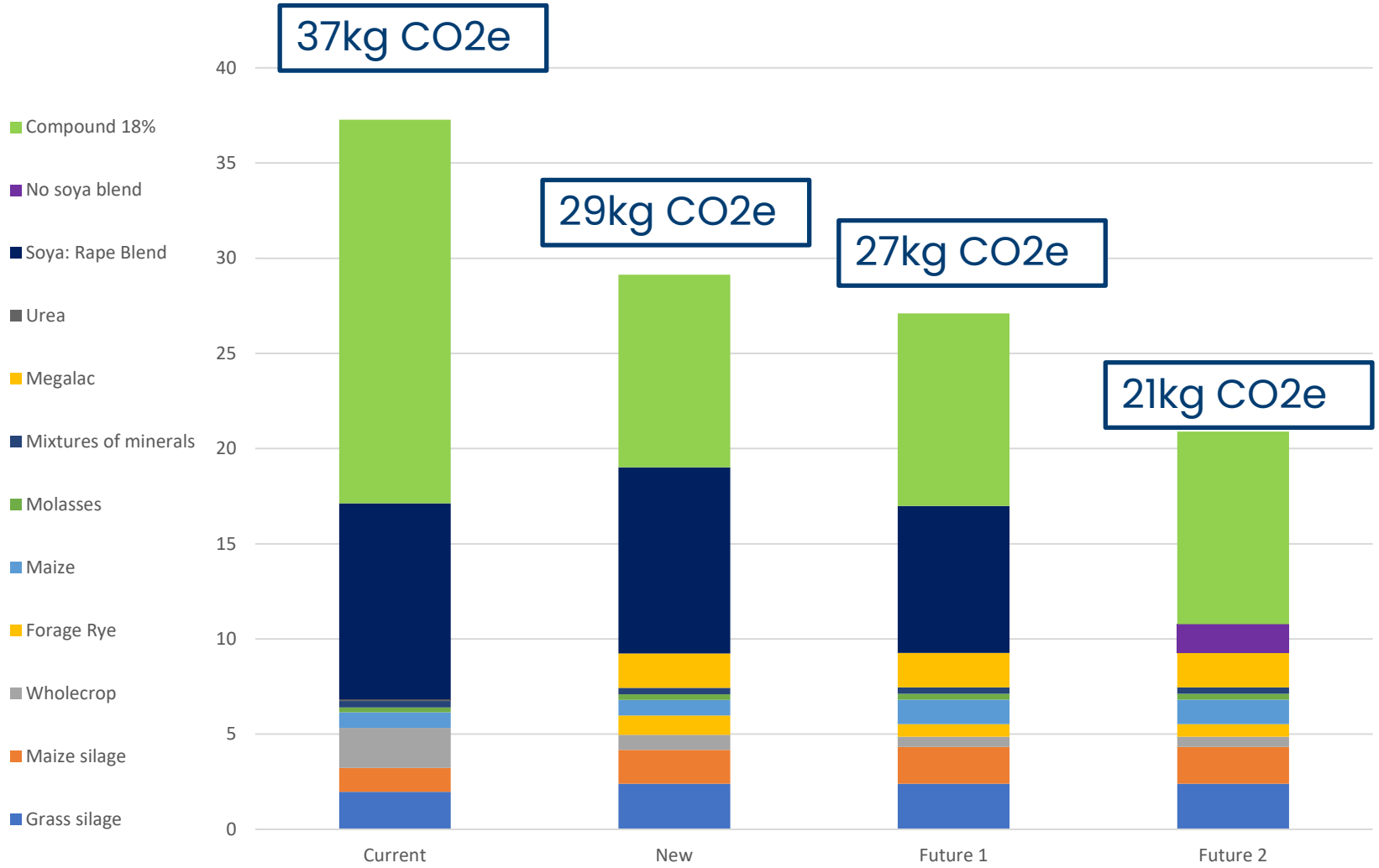
Diet changes for carbon footprint reduction

10%



Source: Trouw Nutrition MyMilkPrint

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Effect of feed efficiency on carbon footprint

	High DMI	Low DMI	Difference
Feed Intake, kg DMI	22	20	9%
Impact of Diet, kg CO2e	12.95	11.64	10%
Impact per kg milk, kg CO2e/ kg FPCM	1.20	1.12	7%

Source: Trouw Nutrition MyMilkPrint

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Increasing output per unit

10%

- Increasing milk yield by 10% → reduction in carbon footprint by 10%

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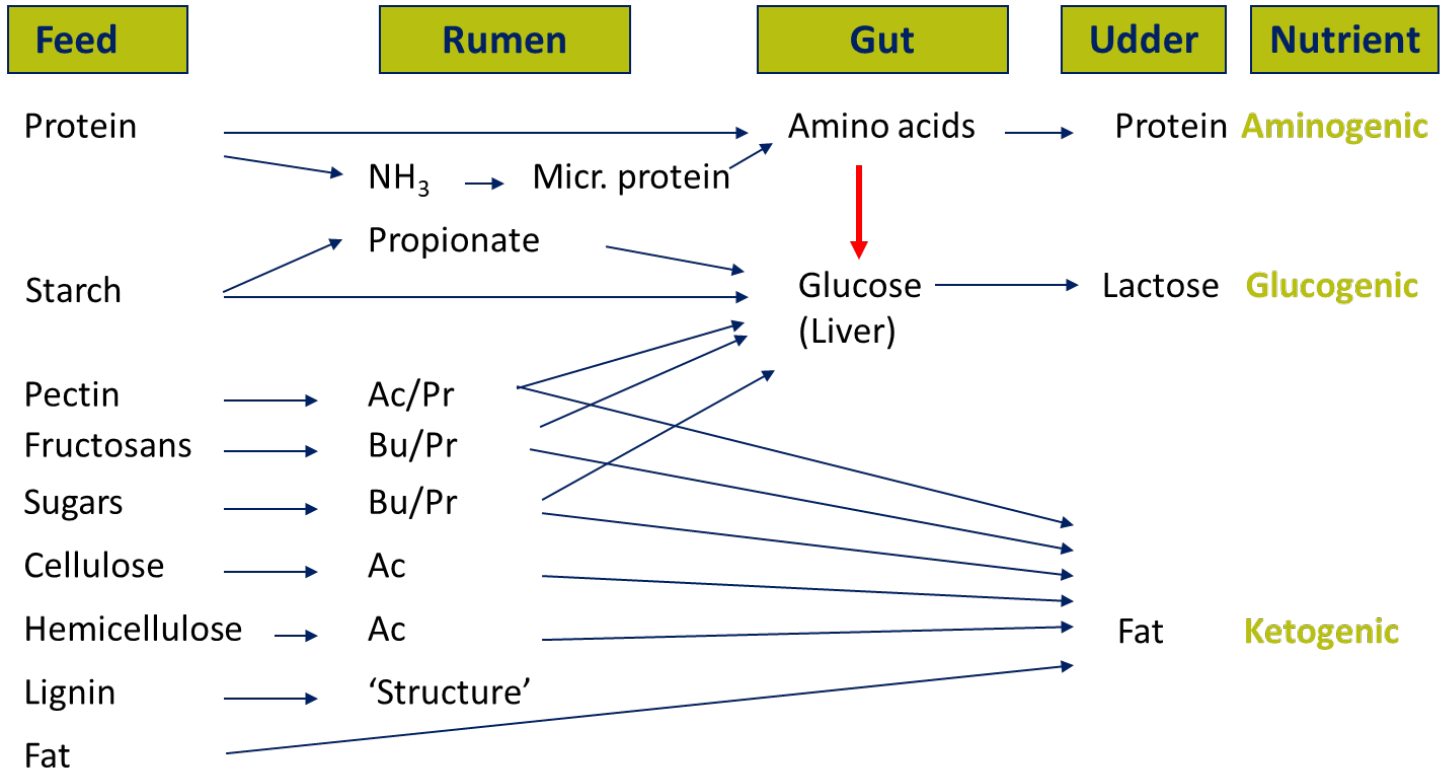
All cows are eating a diet…



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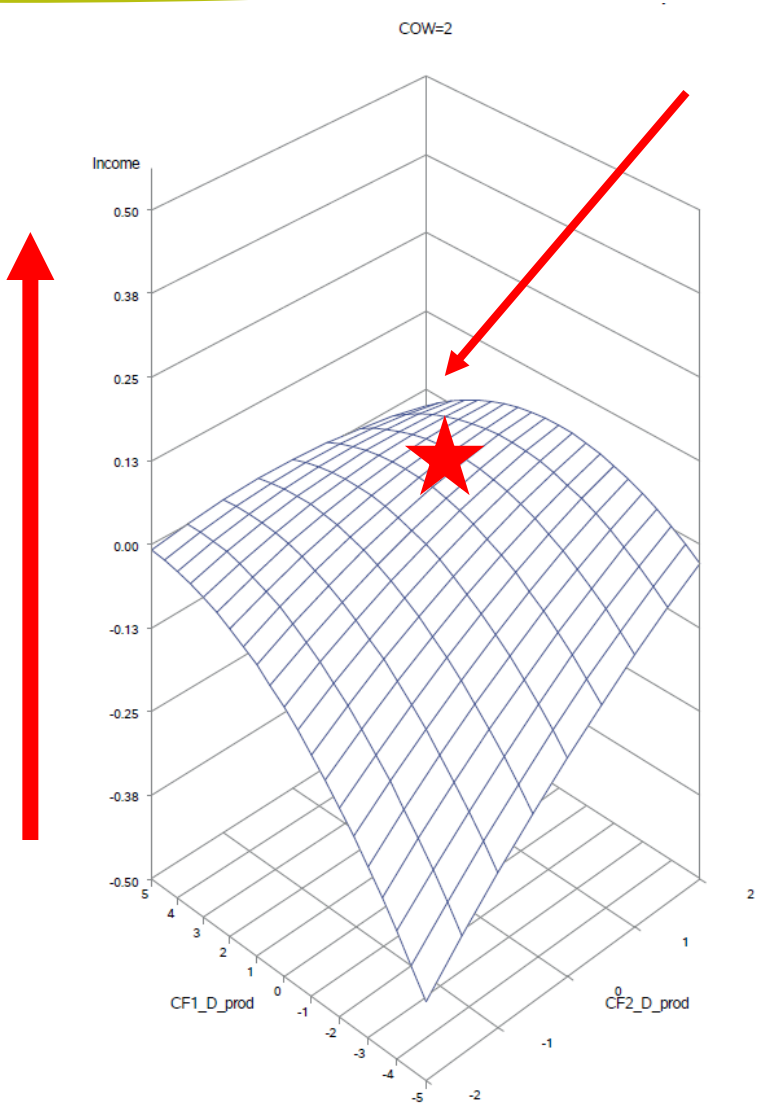
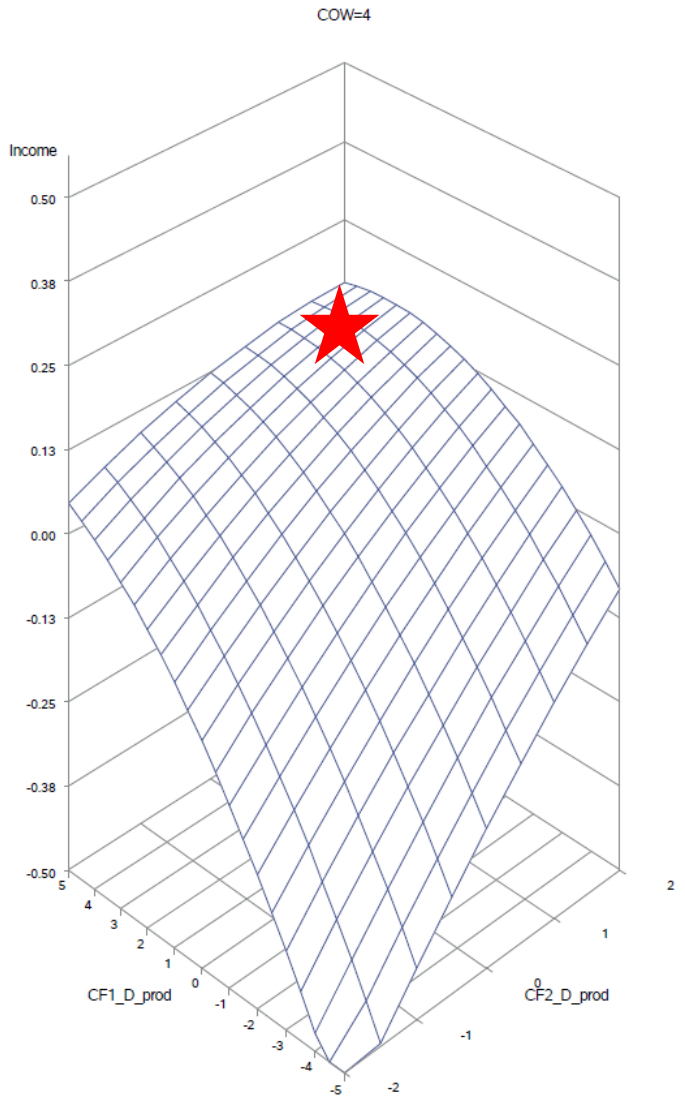
Feeding for marginal litres





- When does feeding concentrates become unprofitable?
- Profitable to feed concentrates = more litres of milk
  - Dilute GHG
  - Balanced diet
- Not profitable; increase GHG emissions, no increase in litres

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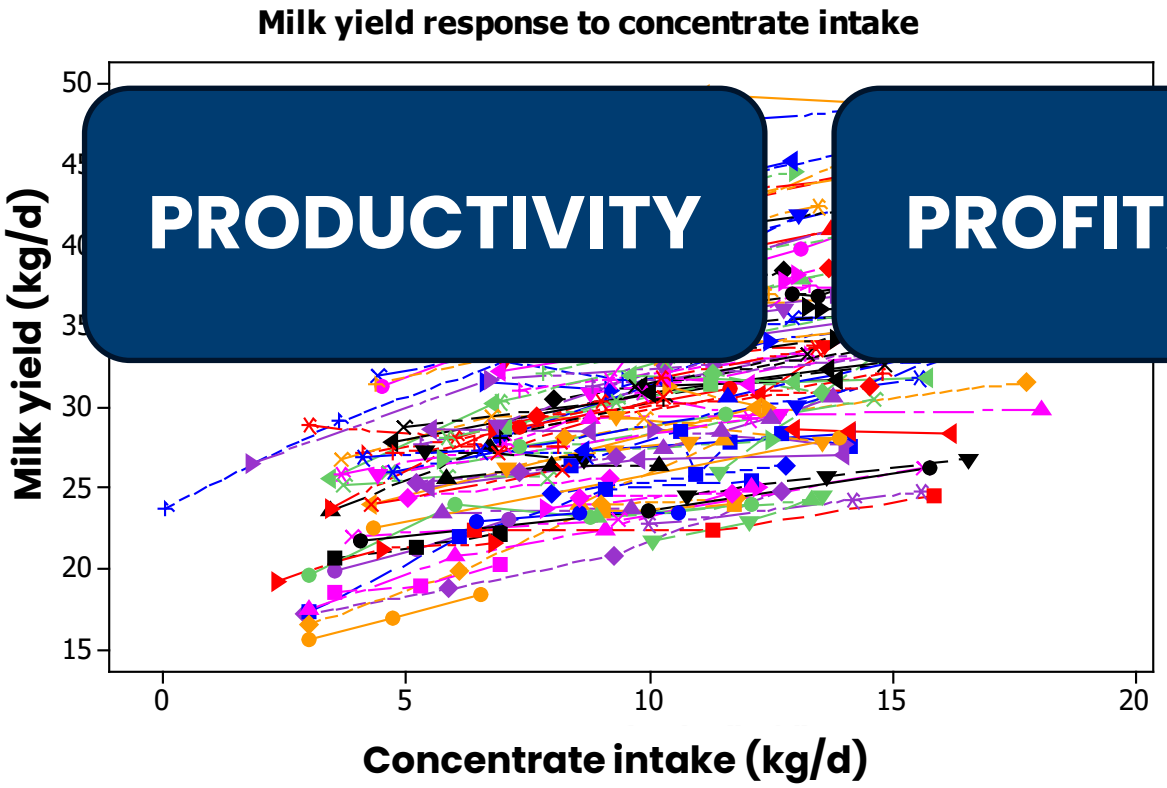
Milk yield ABSOLUTE vs. Milk yield RESPONSE

Current
How much **milk** from 10 kg of concentrate?

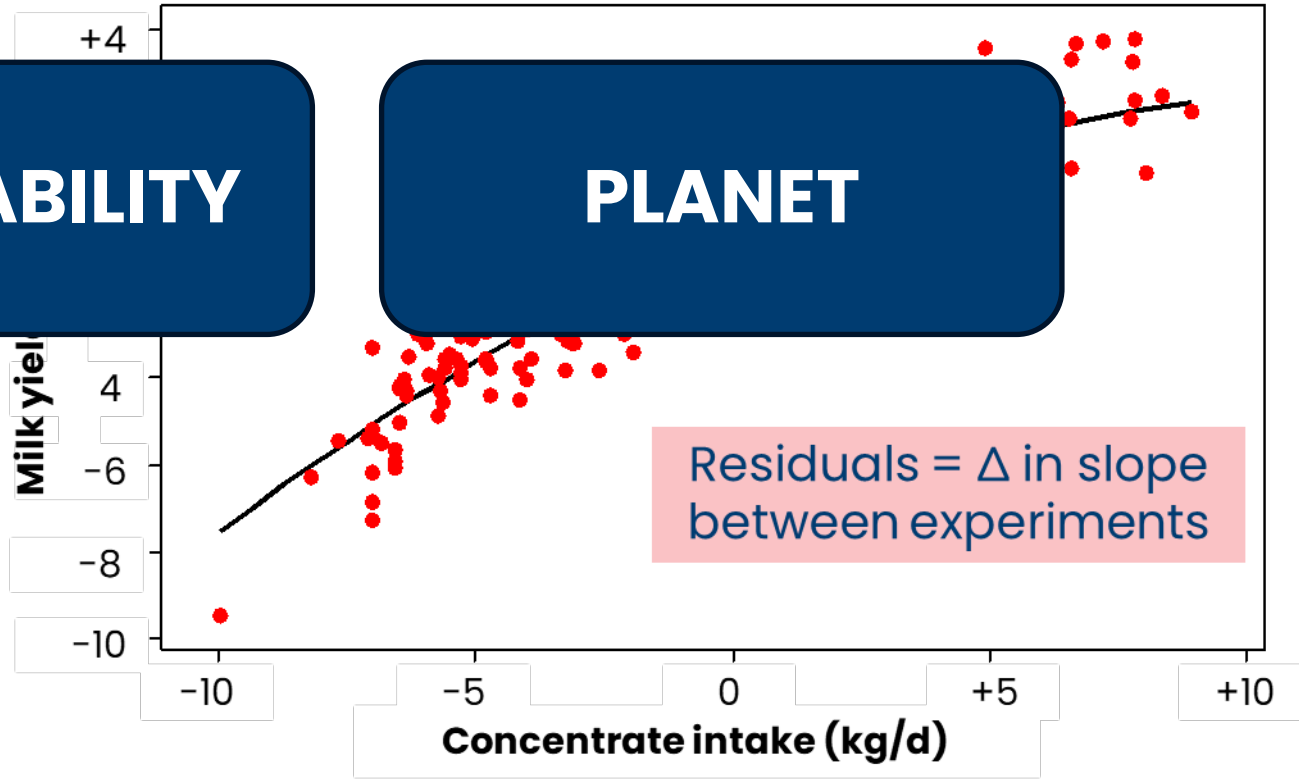
THE FUTURE
How much **more milk** from 1 kg extra of concentrate?



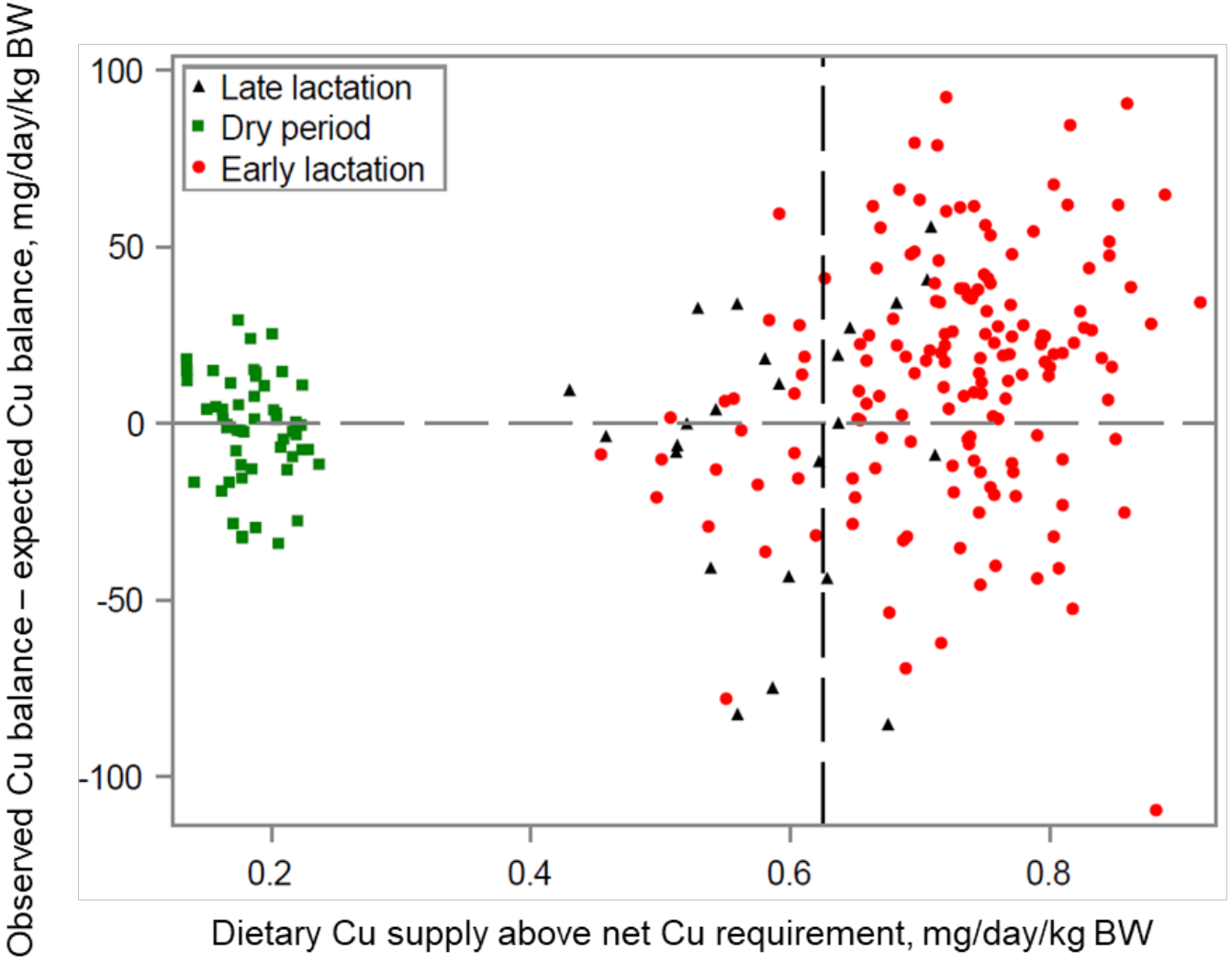
PRODUCTIVITY

PROFITABILITY

PLANET



Responsible Minerals



American Society for Nutrition

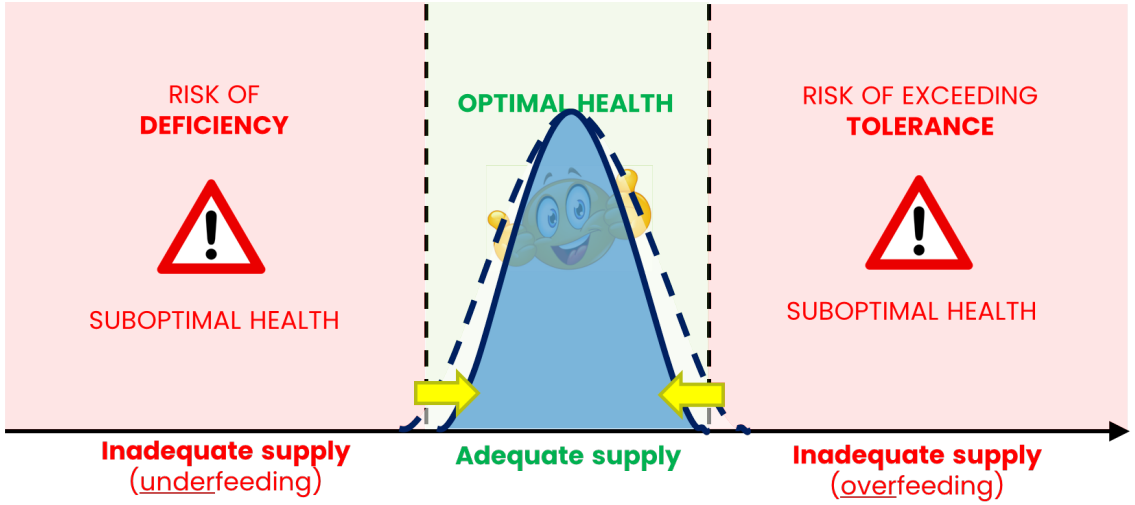
JN THE JOURNAL OF NUTRITION

journal homepage: www.journals.elsevier.com/the-journal-of-nutrition

Nutrient Physiology, Metabolism, and Nutrient-Nutrient Interactions

Zinc, Copper, and Manganese Homeostasis and Potential Trace Metal Accumulation in Dairy Cows: Longitudinal Study from Late Lactation to Subsequent Mid-Lactation

Jean-Baptiste Daniel [1,*], Daniel Brugger [2], Saskia van der Drift [3], Deon van der Merwe [3,4], Nigel Kendall [5], Wilhelm Windisch [6], John Doelman [1], Javier Martín-Tereso [1]



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Responsible Minerals

Figure 1: NDF Digestibility: Selko IntelliBond vs Sulfates

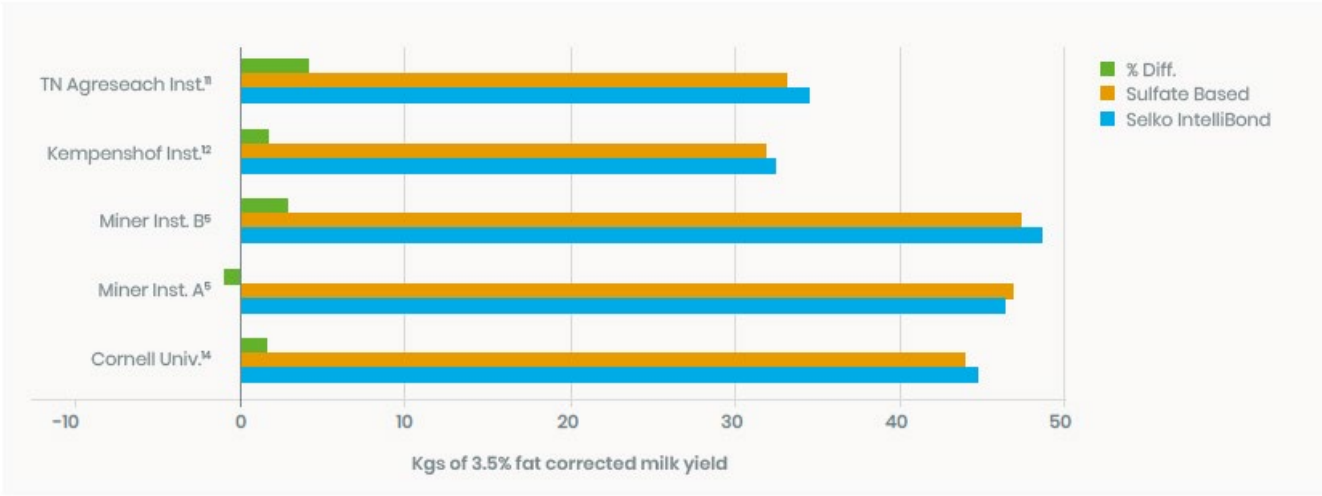
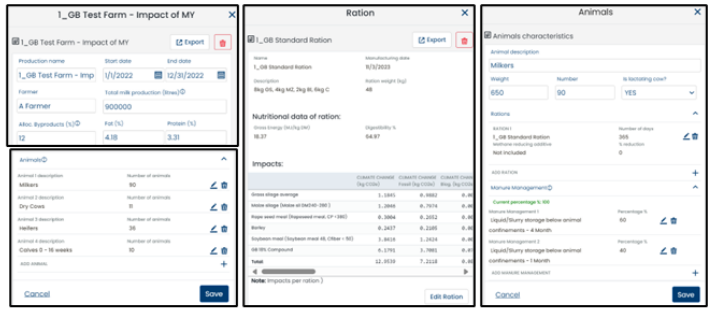
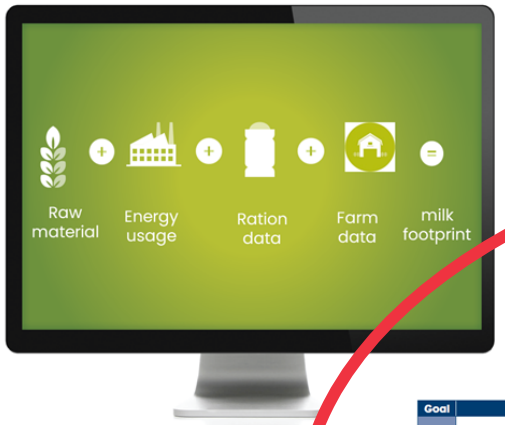


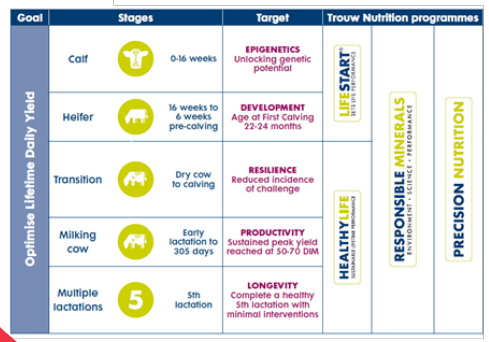
Figure 2: Selko IntelliBond Impact on Milk Yield

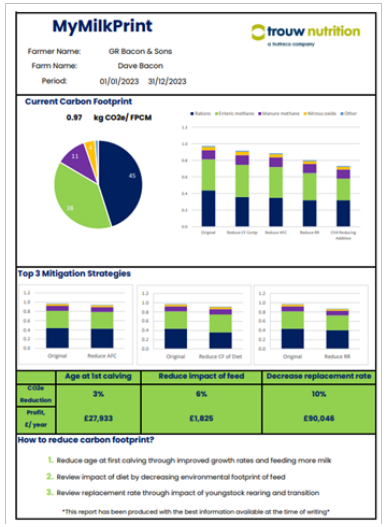
1.5–2%

Process of environmental footprinting









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What if?

MyMilkPrint

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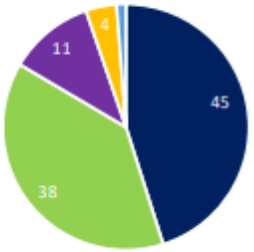
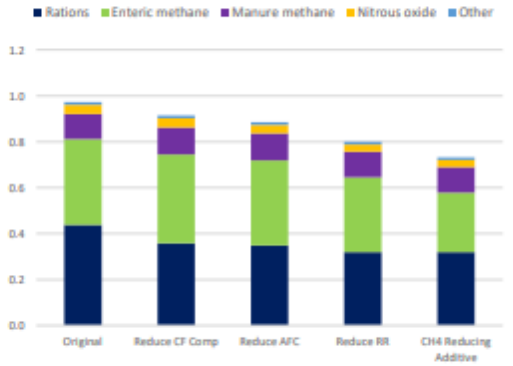
Farmer Name: GR Bacon & Sons
Farm Name: Dave Bacon
Period: 01/01/2023 31/12/2023

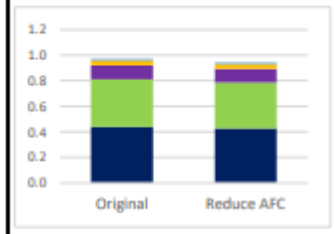
Current Carbon Footprint

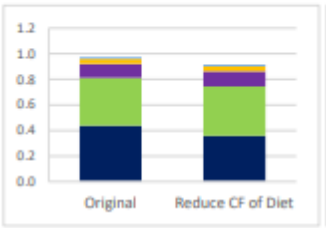
0.97 kg CO2e/ FPCM

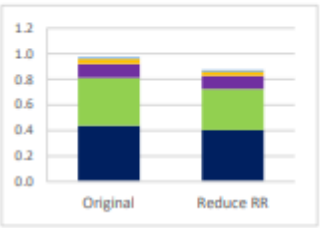




Top 3 Mitigation Strategies







	Age at 1st calving	Reduce impact of feed	Decrease replacement rate
CO2e Reduction	3%	6%	10%
Profit, £/ year	£27,933	£1,825	£90,046

How to reduce carbon footprint?

1. Reduce age at first calving through improved growth rates and feeding more milk
2. Review impact of diet by decreasing environmental footprint of feed
3. Review replacement rate through impact of youngstock rearing and transition

This report has been produced with the best information available at the time of writing

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When can we affect change?

2030

- Impact of compound feed/ blend
- Ration formulation
- Forage quality
- CH4 reducing additives

- Decrease culling rates
- Improvements in fertility
- Improvement in milk yield/ constituents

- Decrease AFC
- Reduce replacement rates
- Increase LDY

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Where does carbon footprint reduction come from?

	Baseline
% reduction in carbon footprint	AFC: 26.4 RR: 30% Milk Yield: 9500
kg CO2e/kg milk	1.20
LDY, kg	12.7
Net value £/ cow	-

Source: Trouw Nutrition MyMilkPrint

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Where does carbon footprint reduction come from?

	Baseline	LifeStart	HealthyLife	Precision Nutrition	Environmental Footprint Specific	CH4 Reducing Additives	Total
% reduction in carbon footprint	AFC: 26.4 RR: 30% Milk Yield: 9500	6	5	10	9	(10)	**30** (40)
kg CO2e/kg milk							**0.84** (0.72)
LDY, kg							**22.7**
Net value £/ cow							**£521**

Decrease carbon footprint

Increase efficiency

Increase profitability

Source: Trouw Nutrition MyMilkPrint

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What can we do today?

CALF
Epigenetics

- Colostrum
- Volume intake
- Quality CMR

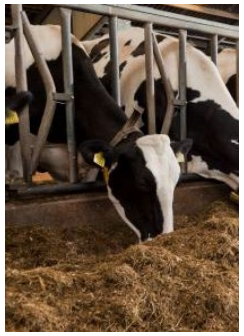
HEIFER
Development

- Precision nutrition
- Insemination target weight
- AFC 22-24 months

TRANSITION
Resilience

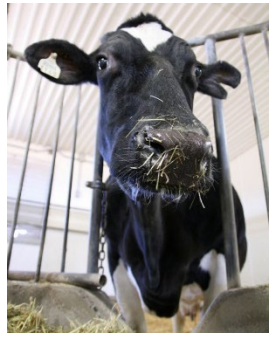
- Precision nutrition
- Mineral supplements
- Post calving drink

MILKING COW
Productivity



- Forage quality
- Balanced diets
- Response modelling

LACTATIONS
Longevity



- Feed additives
- CH4 reducing additives

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How to reduce footprint with tools available today

1. Feed and enteric fermentation contribute approximately 80% of footprint
2. Starts with youngstock!!
3. Review every decision for effect on carbon footprint
4. Marginal improvements lead to big gains
5. Don’t wait to start your journey!

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