TECHNICAL SOLUTIONS TOWARDS ENVIRONMENTAL SUSTAINABILITY OF CATTLE PRODUCTION

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CPH Cattle
December 2019
20 min all incl.

SUSTAINABLE CATTLE PRODUCTION?

DEFINITION (MULTIPLE STAKEHOLDERS):

Animal health and welfare

Animal nutrition

Human health

Milk quality and food safety

Naturalness

Biodiversity

Ressource efficiency

Environment

Climate

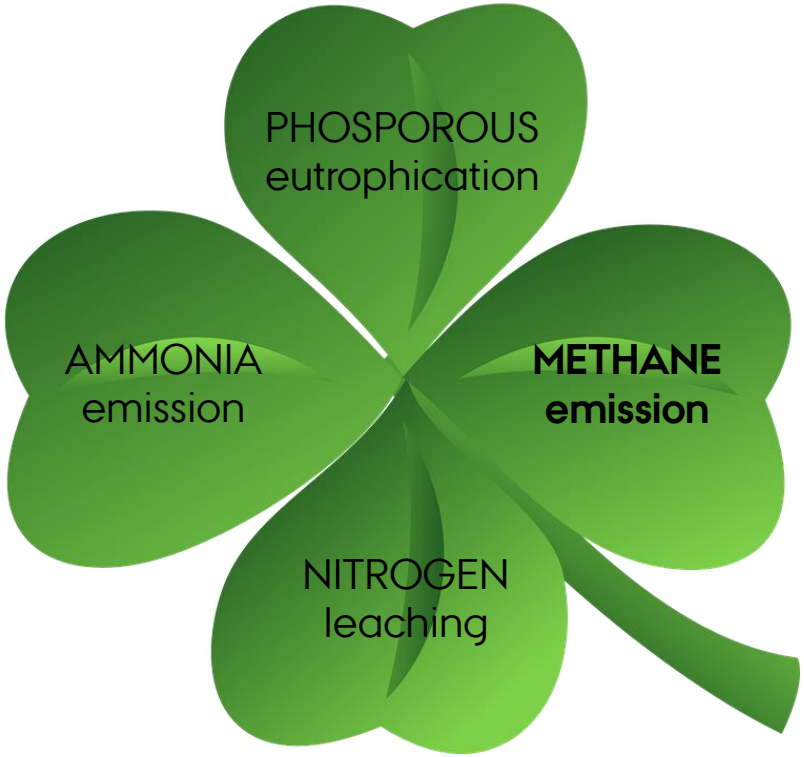
Food waste

Economics

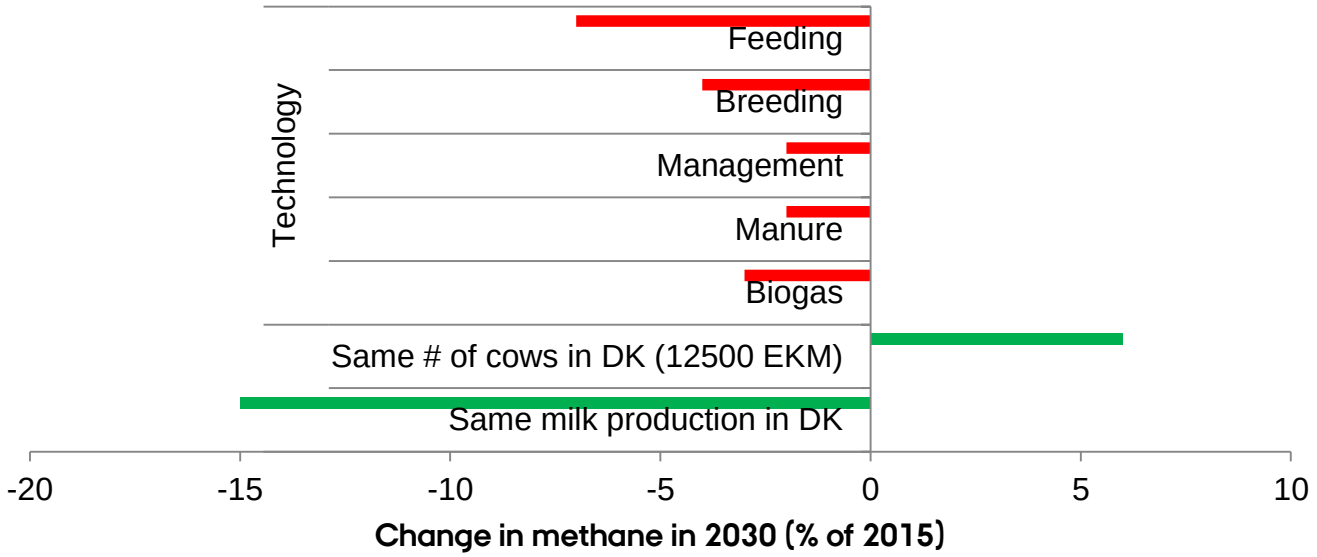
Livelihood

.. .. ..

4 ENVIRONMENTAL CHALLENGES



ELIMINATION IS NOT AN OPTION WITH IMPLEMENTING CURRENT TECHNOLOGIES



Kristensen & Lund (2017)

WHY DOES A COW PRODUCE METHANE ?

(ACTUALLY IT DOES NOT !)

Rumen fermentation:

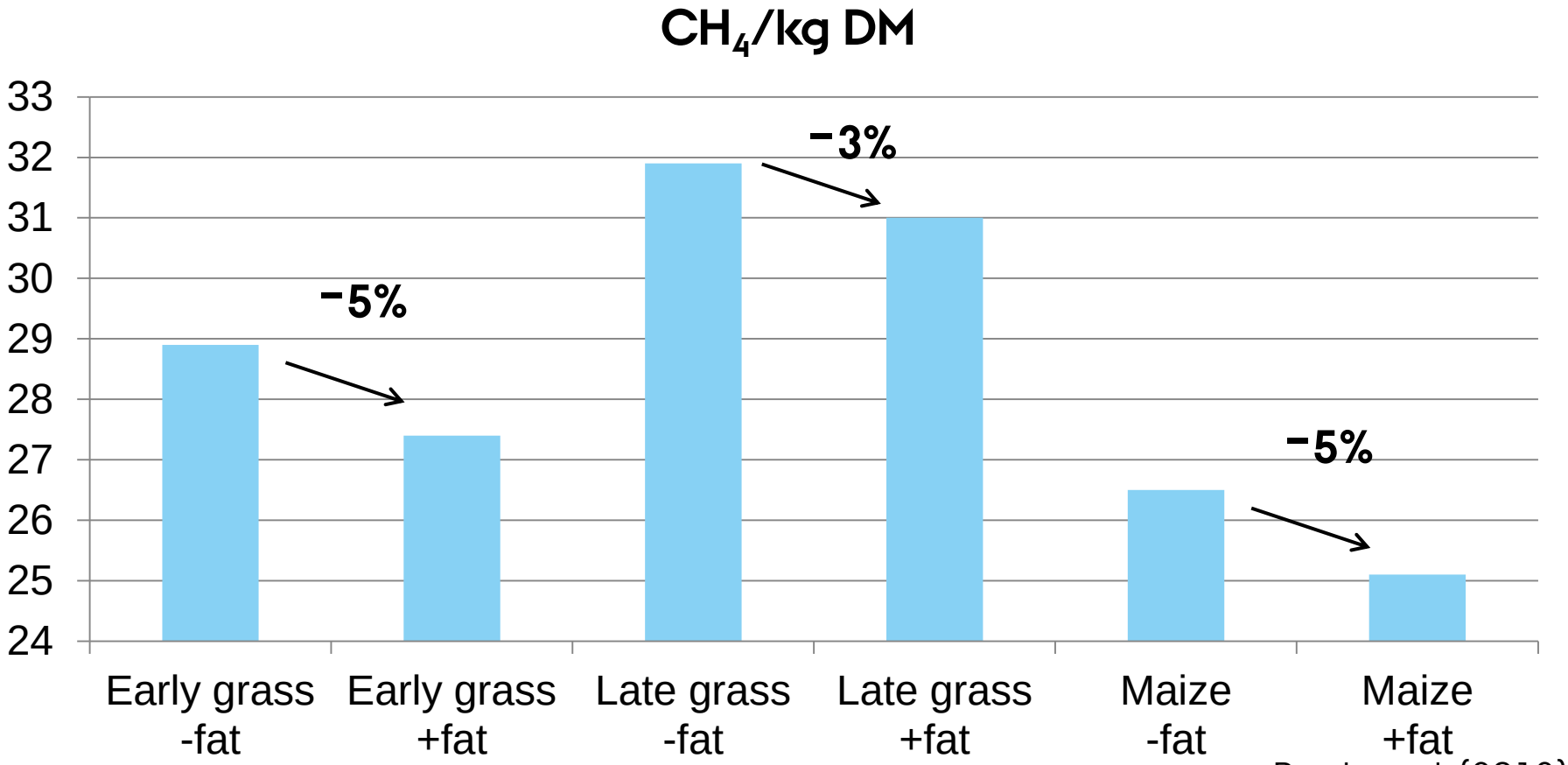
fiber + $2H_2O$ → acetic acid + $2CO_2$ + $\mathbf{4H_2}$

starch + $\mathbf{2H_2}$ → propionic acid + $2H_2O$

sugar → butyric acid + $2CO_2$ + $\mathbf{2H_2}$

$$CO_2 + \mathbf{4H_2} \rightarrow CH_4 + 2H_2O$$

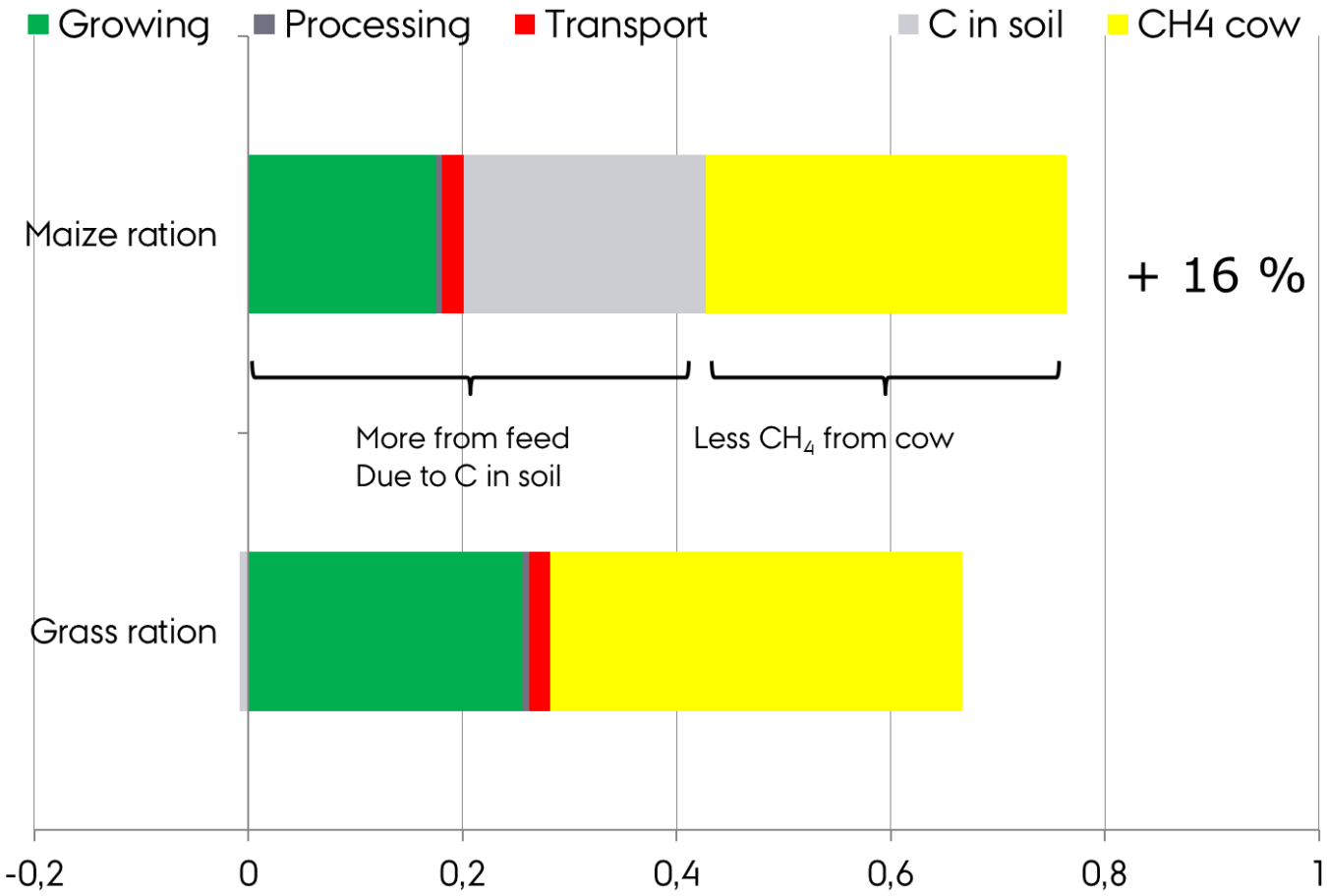
ADDITION OF FAT AND FORAGE TYPE



Brask et al. (2013)

CLIMATE FOOT PRINT OF FEEDS

GHG FROM FEED + CH_4 FROM COW, KG CO_2/KG ECM



Mogensen et al. (2013)

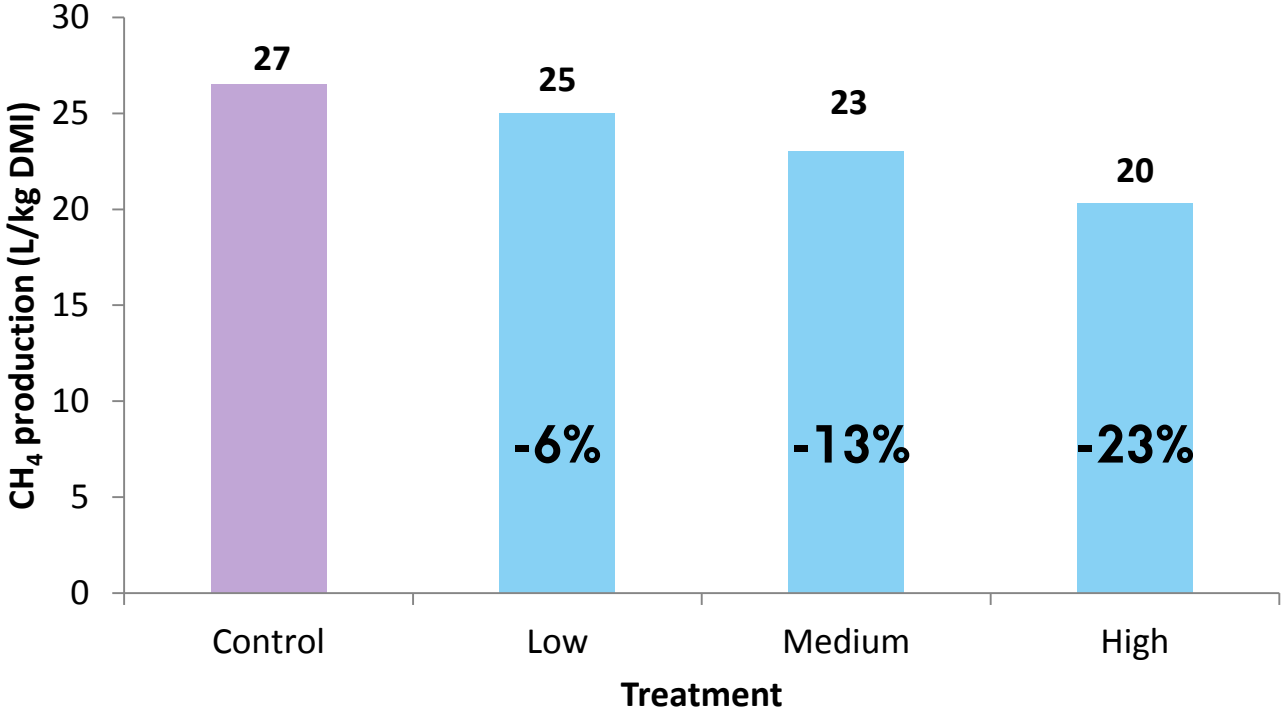
WHERE DOES HYDROGEN GO?

Reaction	ΔG	Substrate availablity
$2CO_2 + 4H_2 \rightarrow CH_4 + 2H_2O$	**-67.4**	**High**
$CO_2 + 4H_2 \rightarrow CH_3COO^- + H^+ + 2H_2O$	**-8.8**	**High**
$SO_4^{2-} + 4H_2 + H^+ \rightarrow$ **HS^-** $+ 4H_2O$	**-84.4**	**Low**
$NO_3^- + H_2 + 2H^+ \rightarrow$ **NO_2^-** $+ 2H_2O$	**-130**	**Low**
$NO_2^- + 3H_2 + 2H^+ \rightarrow NH_4^+ + 2H_2O$	**-371**	**Low**

NITRATE – AN ALTERNATIVE HYDROGEN SINK

$NO_3^- + H_2 + 2H^+ \rightarrow NO_2^- + 2H_2O$

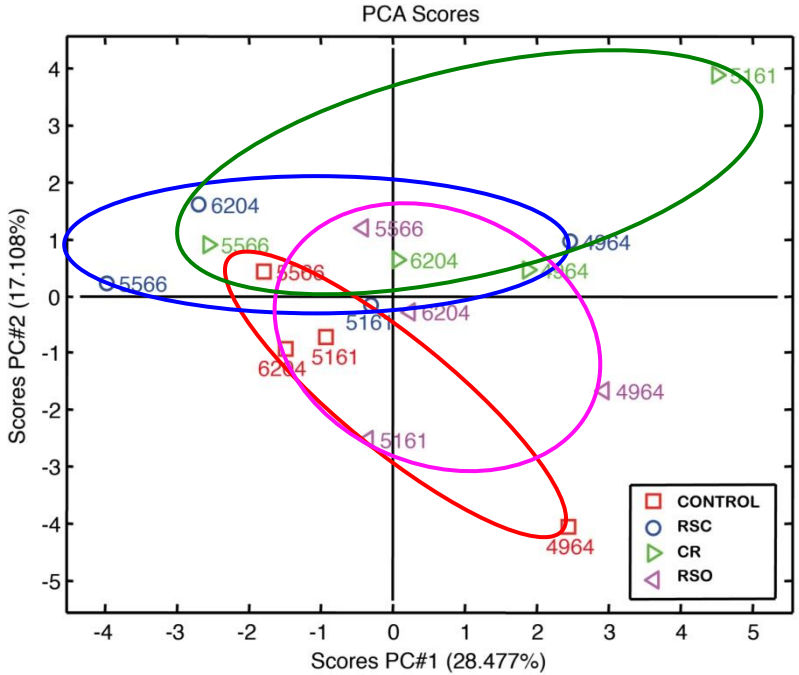
$NO_2^- + 3H_2 + 2H^+ \rightarrow NH_4^+ + 2H_2O$



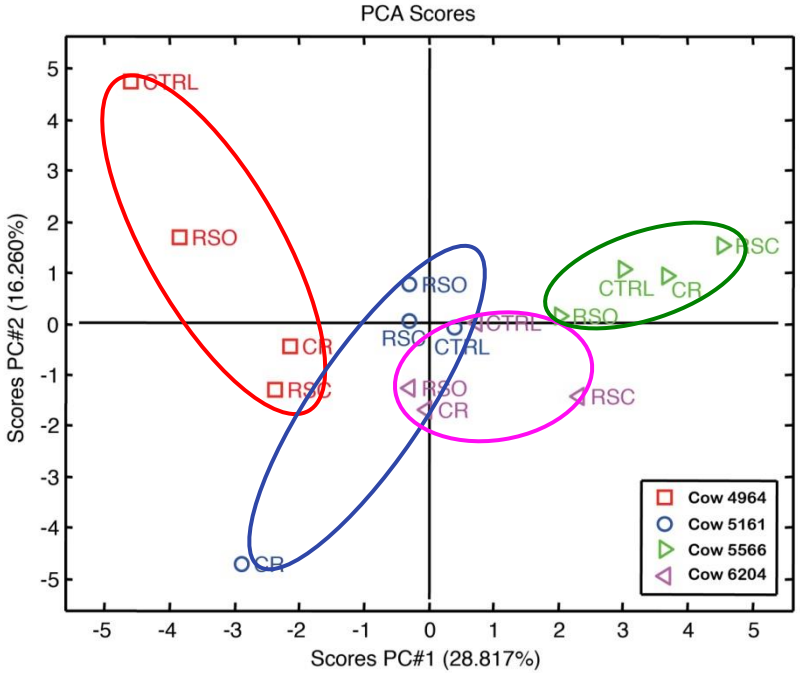
Olijhoek et al. (2016)

RUMEN MICROBIAL COMMUNITY IS IMPORTANT

Feed

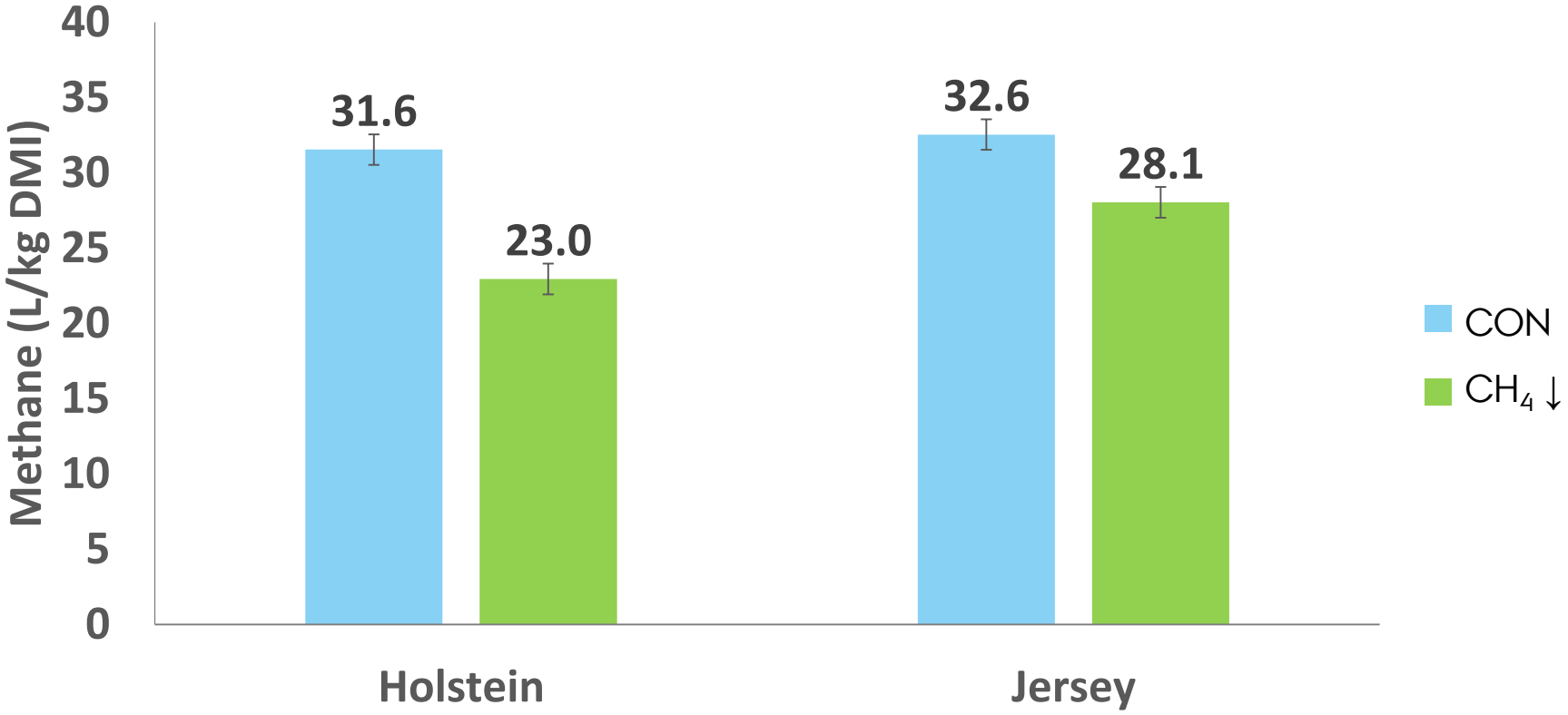


Cow



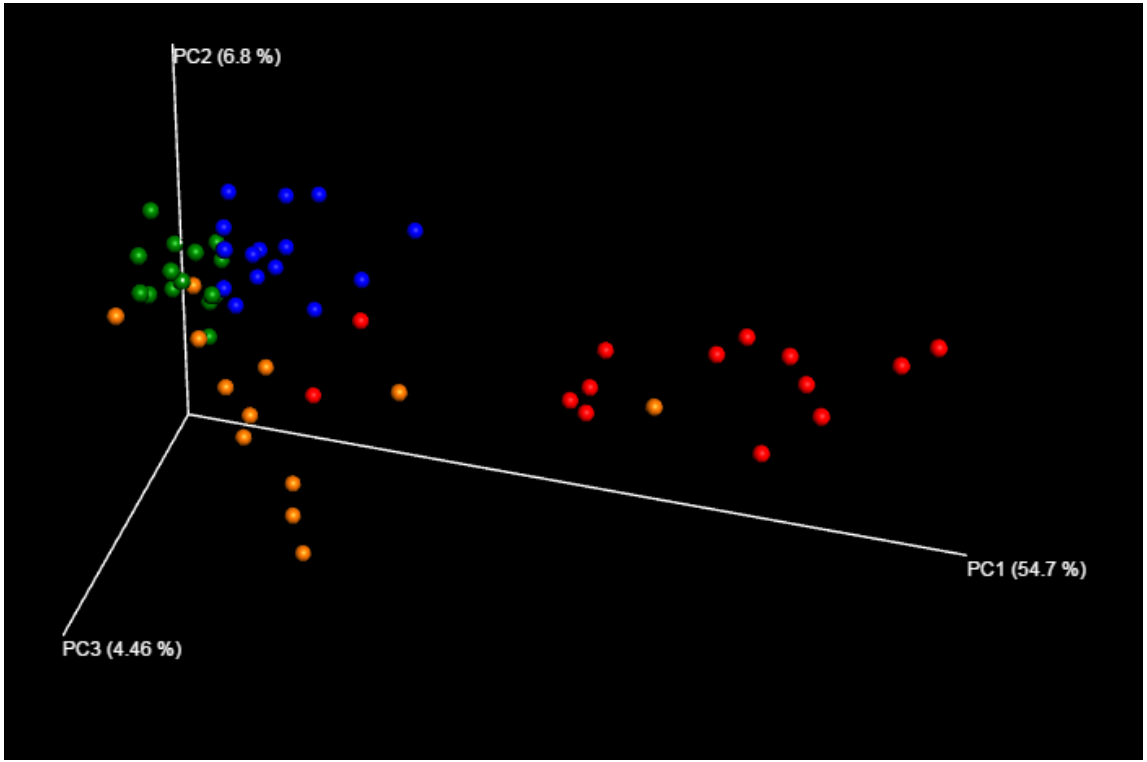
Poulsen et al. (2013)

EFFECT OF BREED



Olijhoek et al. (2018)

EFFECT OF BREED



HOLSTEIN

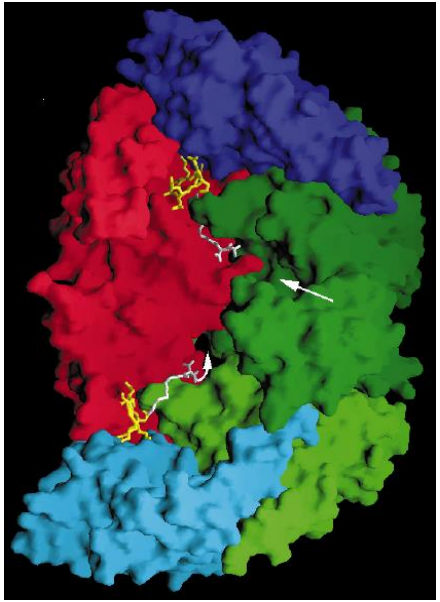
- $CH_4 \downarrow$
- CON

JERSEY

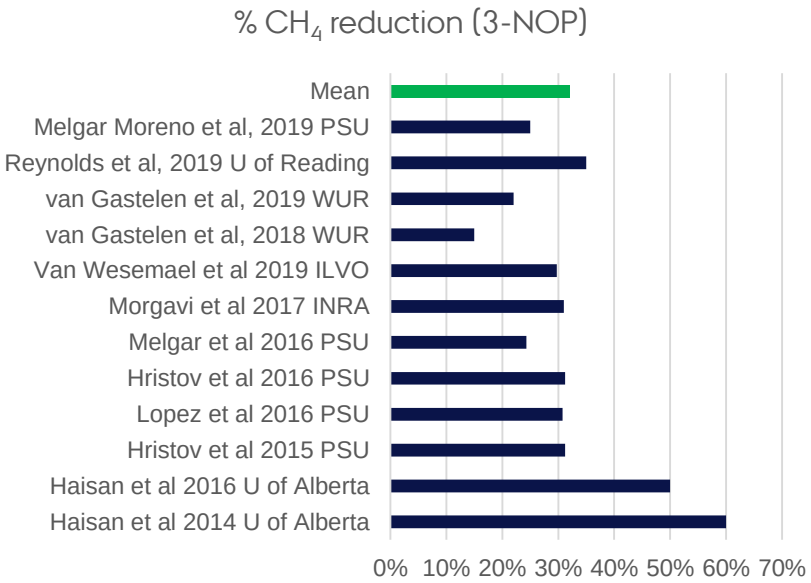
- $CH_4 \downarrow$
- CON

Noel et al. (2018)

FEED ADDITIVES

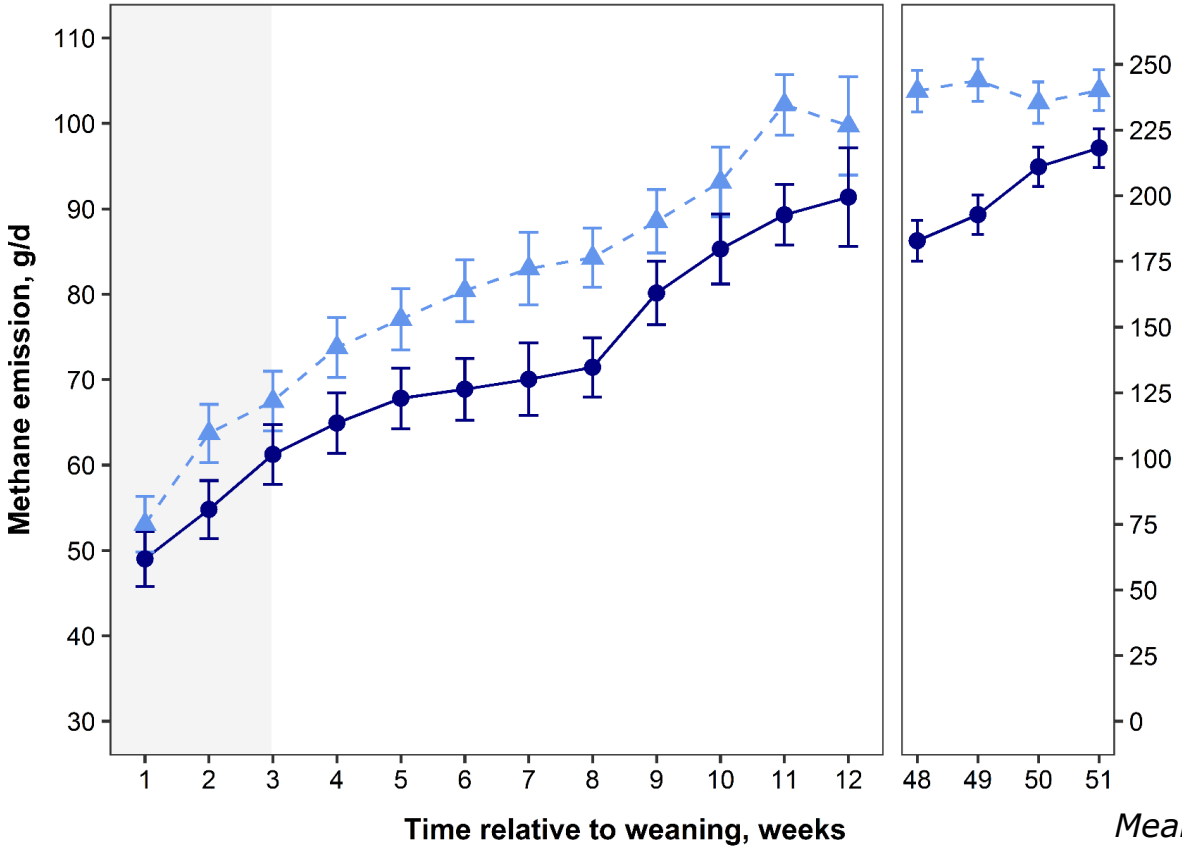


3-NOP inhibits
Methyl Coenzyme M Reductase



Rijnders (2019)

VACCINATION



Meale et al. (2019)

METHANE EXTRACTION AT BARN LEVEL

LandbrugsAvisen.dk | Tilmeld nyhedsbrev | Om os | Annoncering

Log ind

Kvæg PLUS+

“Her kan du læse fagmagasinet Kvæg som e-magasin. Klik her!

Søg her

Køer i klimaforsøg: Metan bliver opsamlet over hvilearealet i stalden

Koens udåndingsluft indeholder drivhusgassen metan. Derfor vil Seges nu opsamle metan i mulehøjde for at undersøge, om det kan gøre dansk mælkeproduktion mere klimavenlig.

25. feb | 12:40 | 0

Skrevet af Landbrugsavisen.dk

Arkivfoto.

Ved Hammel nær Aarhus ligger en række køer i deres sengebåse og puster ud.

De ved ikke, at de er med i et forsøg der skal vise, om man ved at opsamle metan fra

Seneste fra konsulenterne

Sådan forebygger du ketose hos malkekøer
8. okt | 11:13 | Konsulent

Det let fordøjelige grovfoder er brugt – brug for billigt økokorn til foder
30. sep | 10:18 | Konsulent

Klovbeskæring: Vælg korrekt hyppighed og tidspunkt
25. sep | 14:23 | Konsulent

Skru helt op for billigt omlægningskorn til øko-køerne
23. sep | 11:21 | Konsulent

Udsuget er placeret ca. 15 cm under sengebåsens øverste frontrør. Foto: SEGES

LOOKING FORWARD

We can and will reduce methane **intensity (L/kg milk)** significantly by optimizing current technologies – but what about **amount (L/cow)**?

What is the phenotype of "the cow of the future" with low methane/kg milk?

Compounds that inhibit methanogens is the most promising **future** solution to obtain a significant reduction in emissions. Consumer acceptance? Business case?

Vaccination – maybe?

Taking out methane at barn level – maybe?

Development of on-farm technical measurement techniques is essential for farmers to validate the effect of any (dietary) intervention.