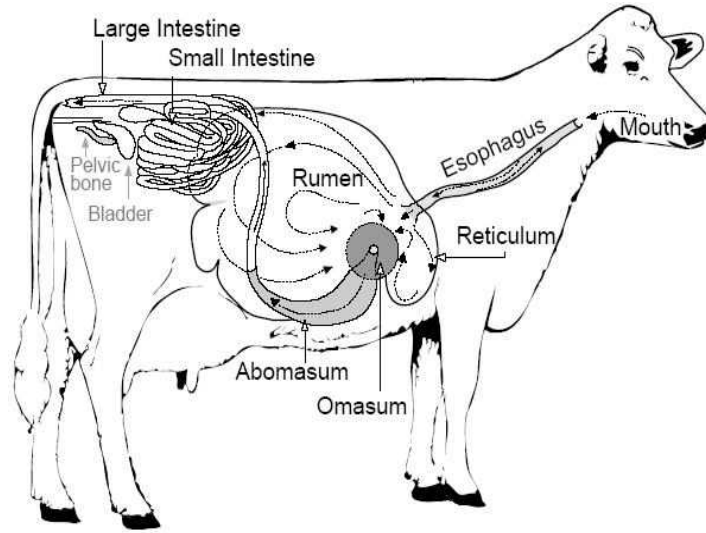


CATTLE & CLIMATE

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COW RUMEN PHYSIOLOGY



Microbial fermentation of carbohydrate in the rumen

Volatile fatty acids

Acetate → Fatty acids, Energy

Propionate → glucose

Butyrate → Fatty acids, Energy

Microbial protein and AA

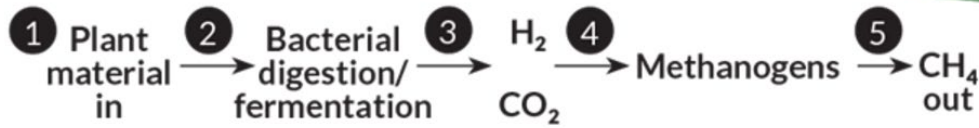
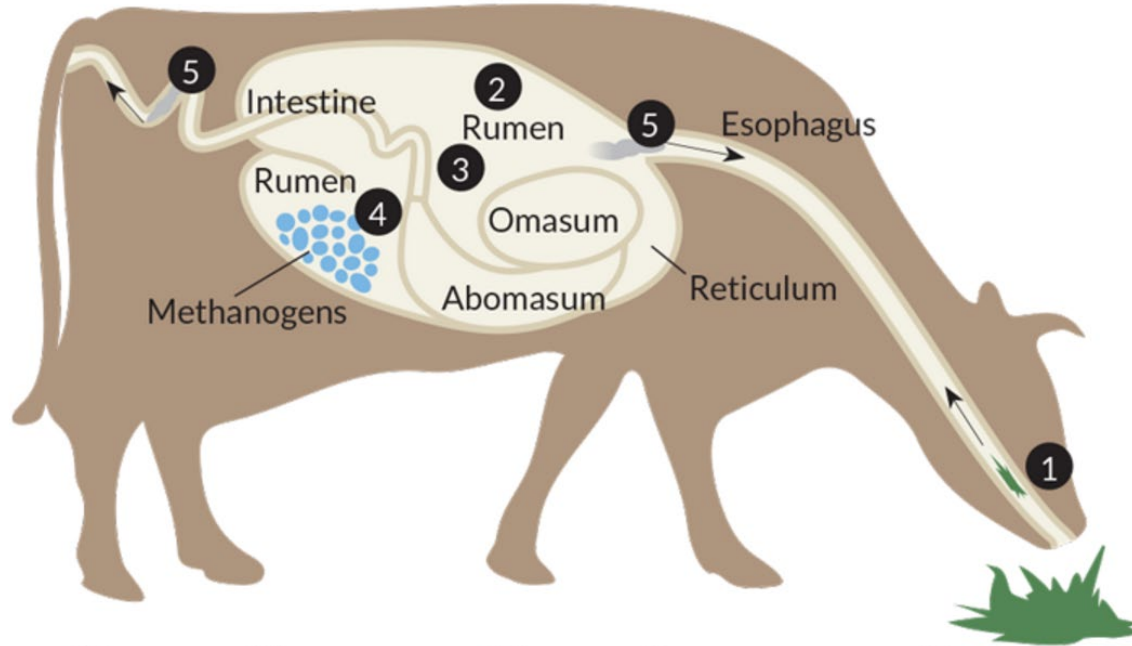
(glucose) / gluconeogenesis

No requirement for AA in the feed

No requirement for glucose in the feed

WHY DOES A COW PRODUCE METHANE ?

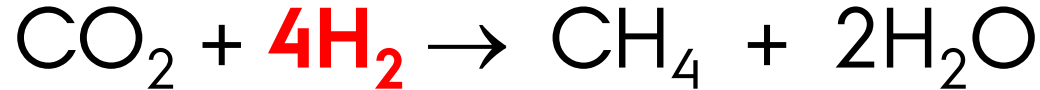
(ACTUALLY IT DOES NOT !)



HYDROGEN IS THE KEY TO METHANE

CHO fermentation:

- > $C_6H_{12}O_6 + 2H_2O \rightarrow 2CH_3COOH + 2CO_2 + 4H_2$ **acetic acid, fiber**
- > $C_6H_{12}O_6 + 2H_2 \rightarrow 2CH_3CH_2COOH + 2H_2O$ **propionic acid, starch**
- > $C_6H_{12}O_6 \rightarrow CH_3CH_2CH_2COOH + 2CO_2 + 2H_2$ **butyric acid, sugar**

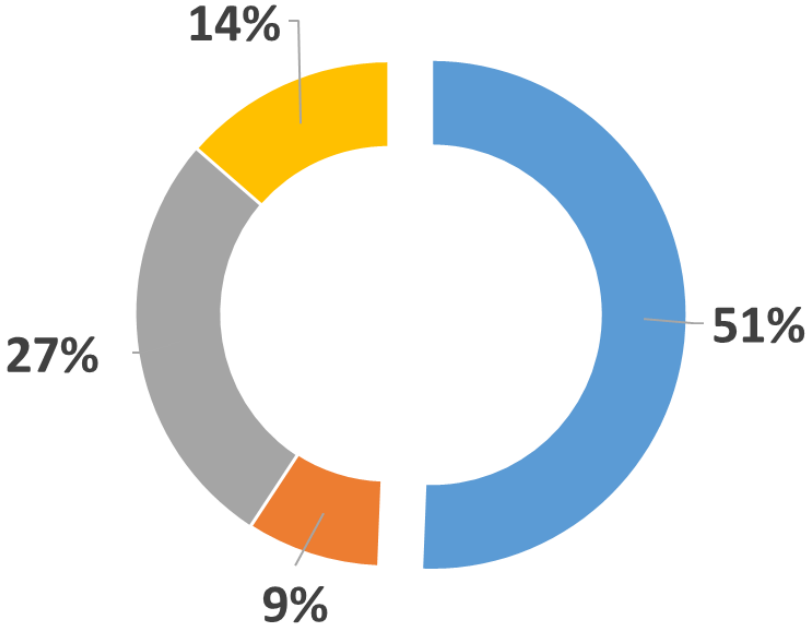


Danish cow: 600 L CH_4 /cow/day

TOP 5 CONTRIBUTORS TO DANISH AGRI GHG

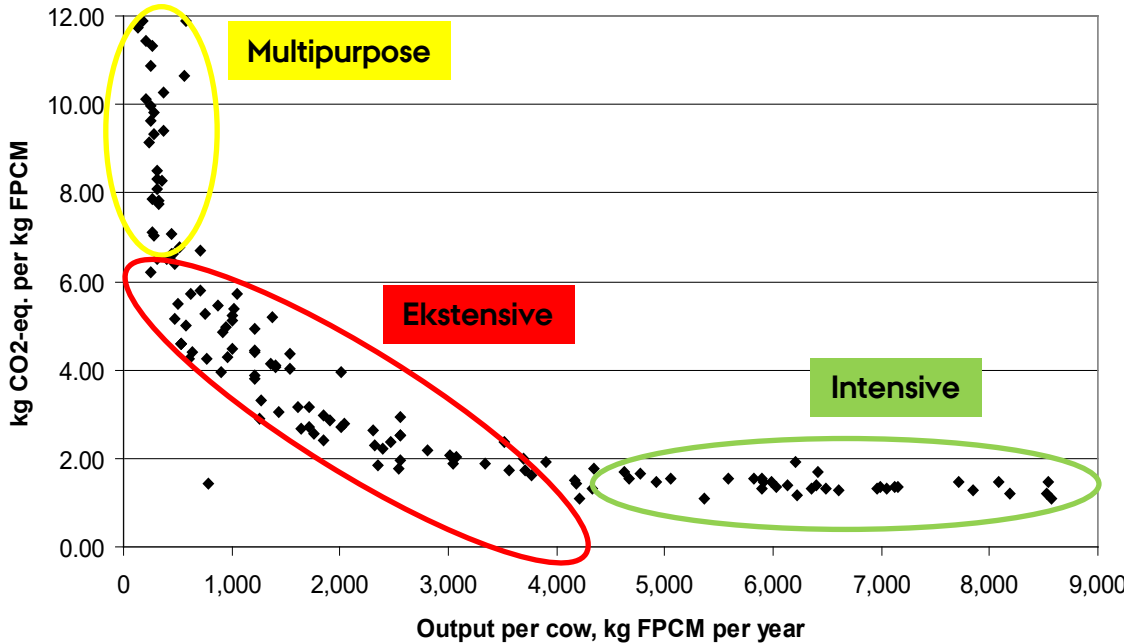
- 1. Enteric fermentation, mainly from ruminants, CH₄ (33%)*
2. Manure management, CH₄ (20%)
3. Inorganic N fertilizer, N₂O (10%)
4. Manure on soil, N₂O (9%)
5. Crop residues, N₂O (8%)

DANISH MILK PRODUCTION (ON FARM)

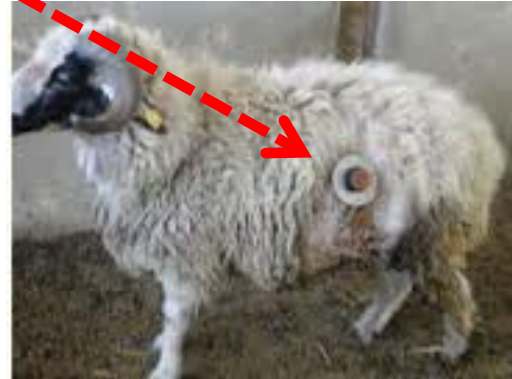
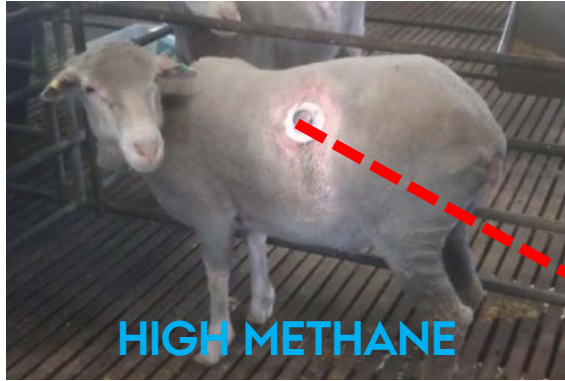


PRODUCTION LEVEL IS IMPORTANT

1 dot = 1 country

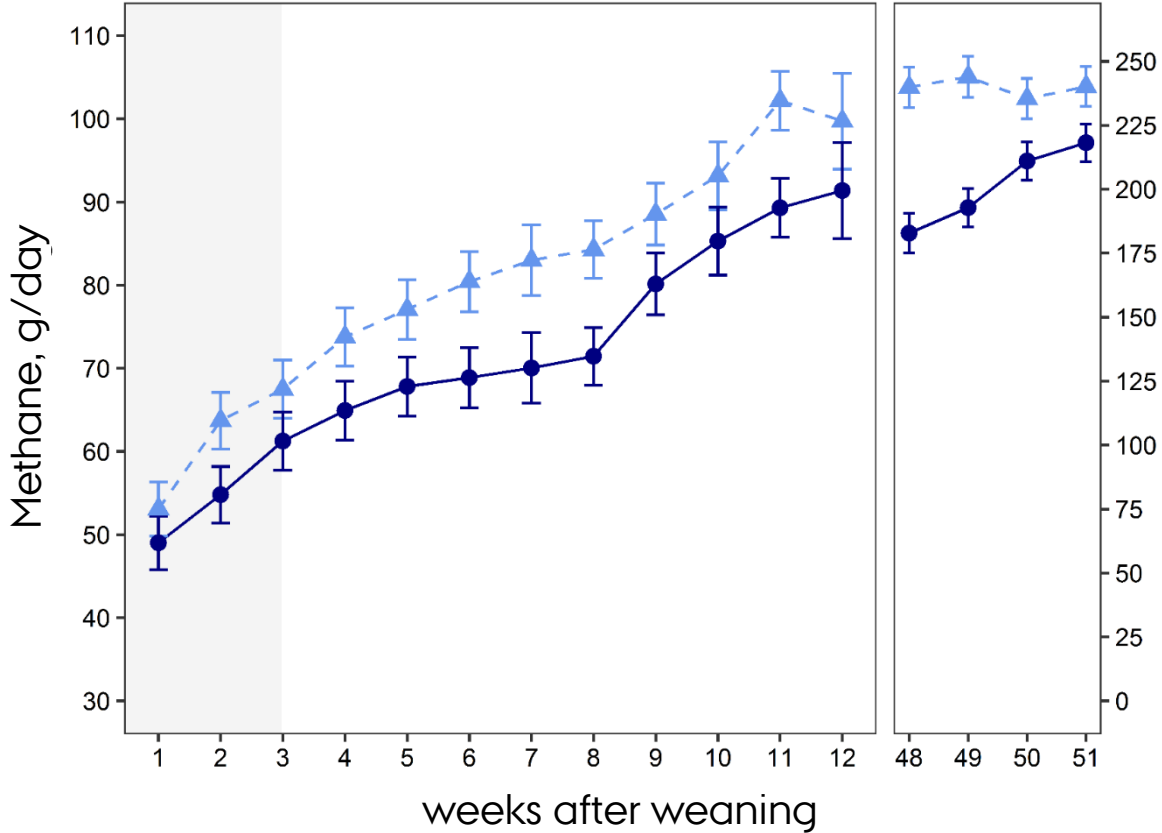


ANIMAL VARIATION

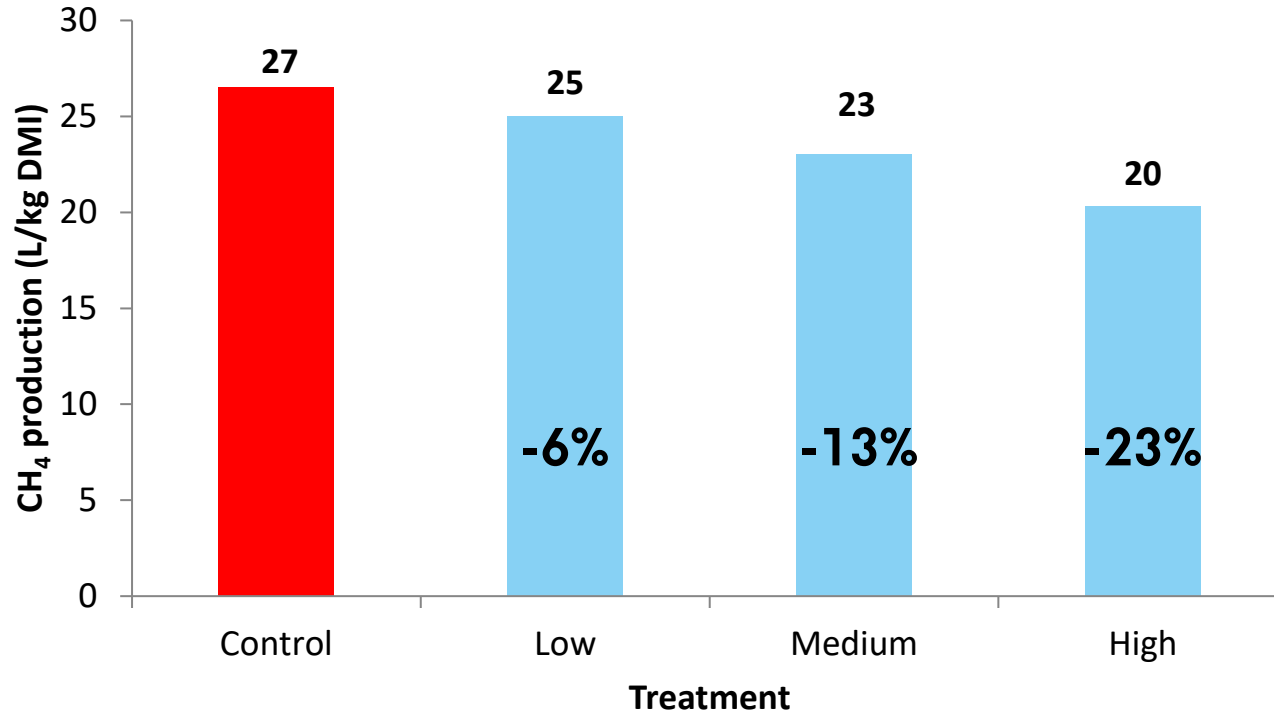
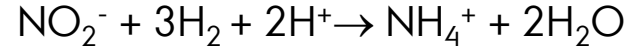
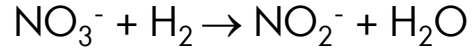


EARLY LIFE INTERVENTION

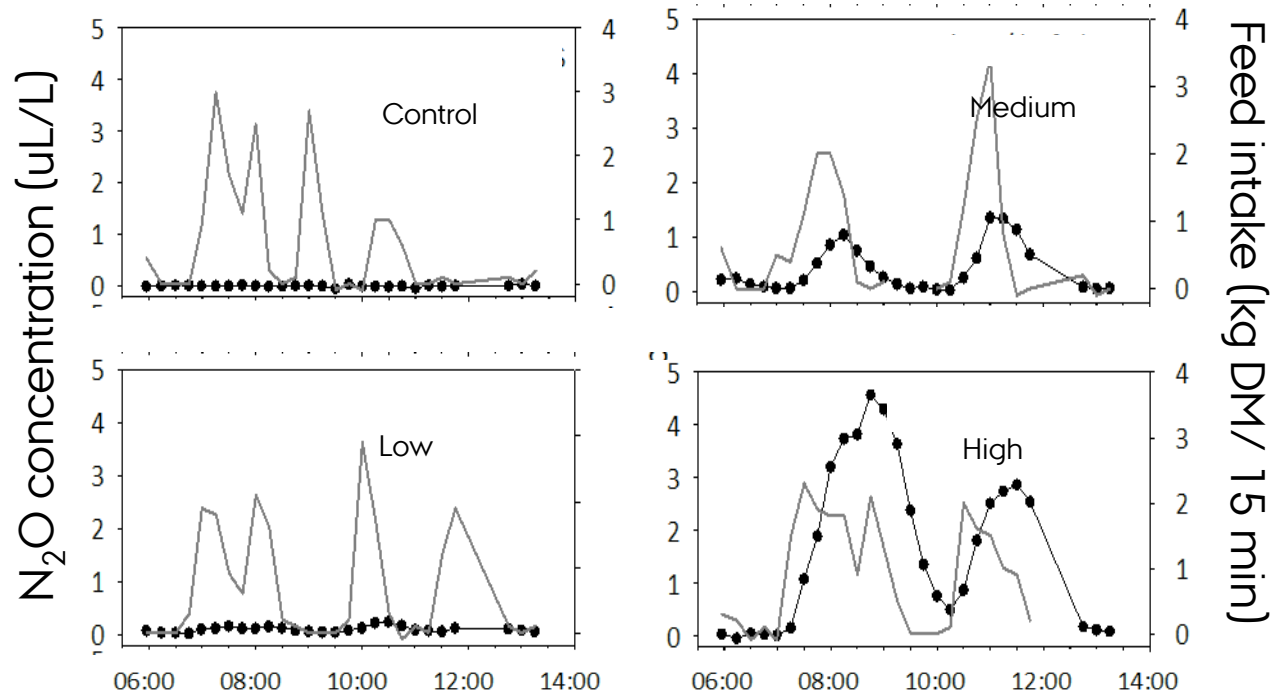
Feed additive up until 3 weeks after weaning (11 weeks old).



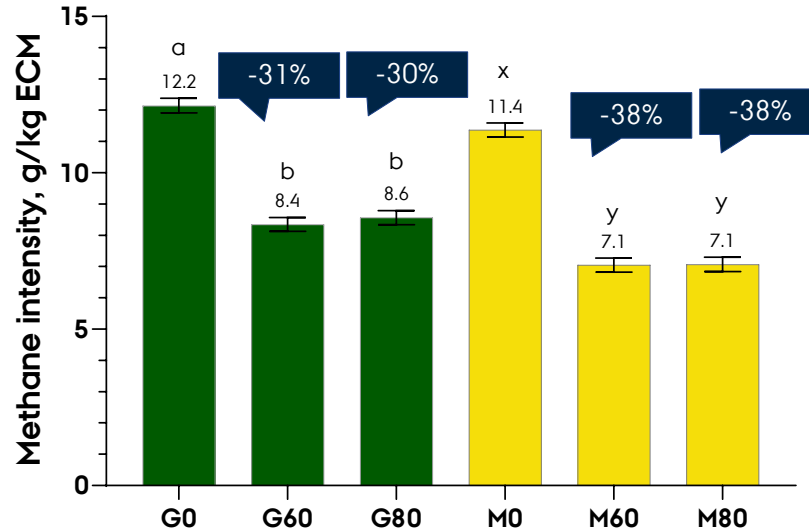
NITRATE – A HYDROGEN SINK



N₂O (256 X CO₂)



Methane per kg ECM

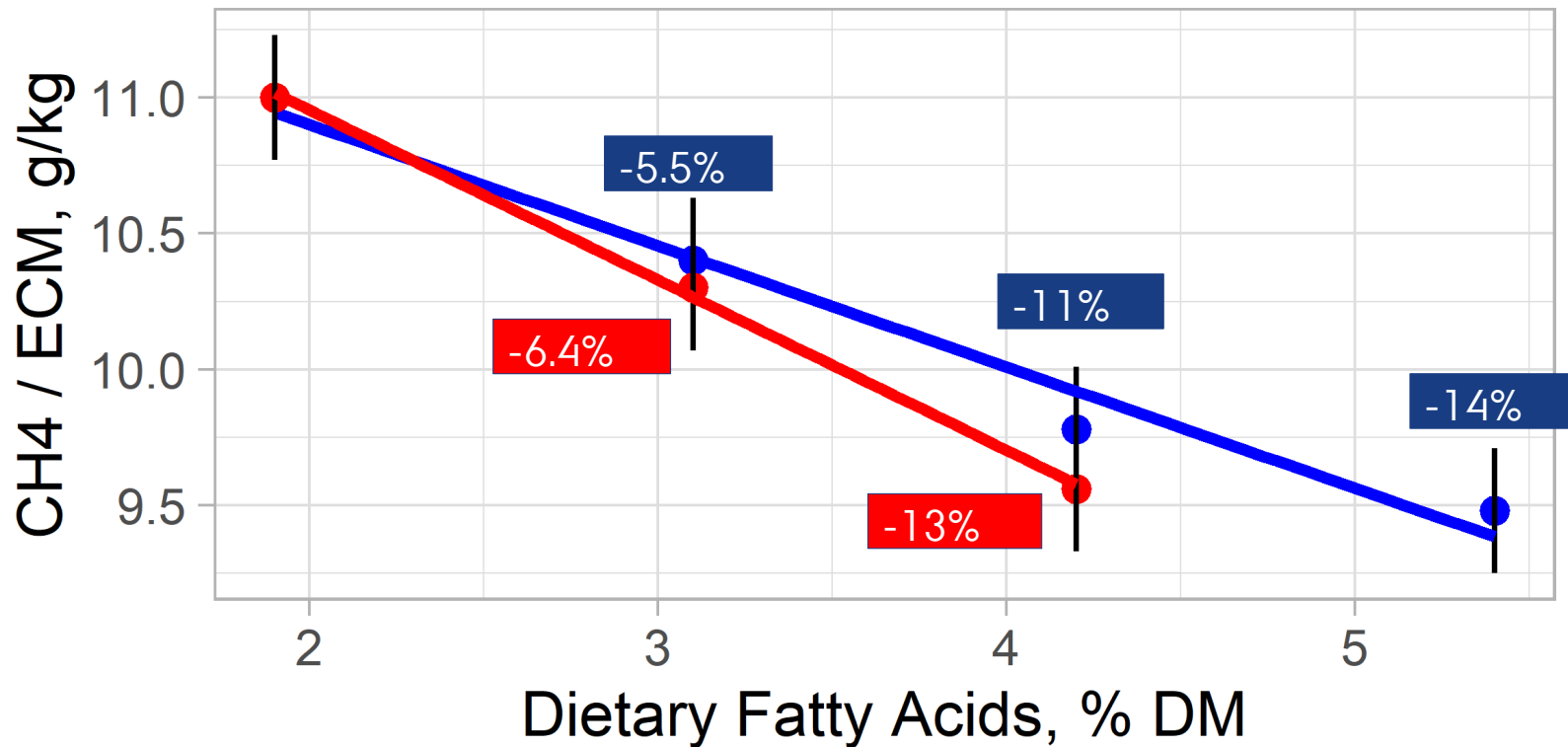


	P-value
Forage type	<0.01
3-NOP	<0.01
Week	<0.01
Forage type × 3-NOP	0.28

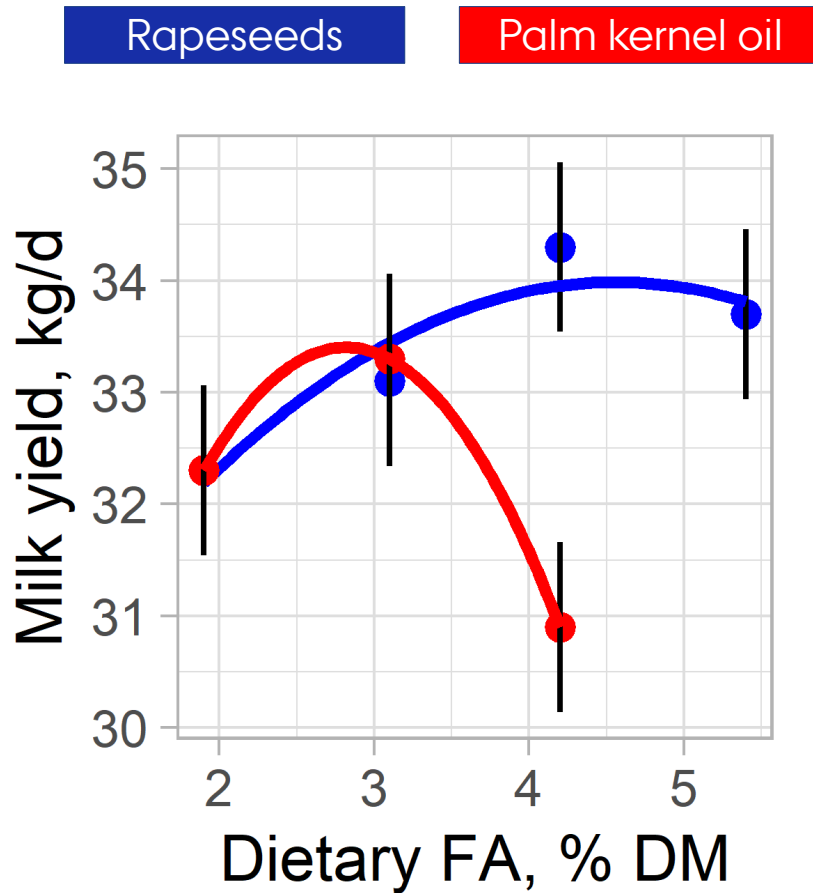
FATTY ACIDS, NOT FERMENTED IN THE RUMEN

Rapeseeds

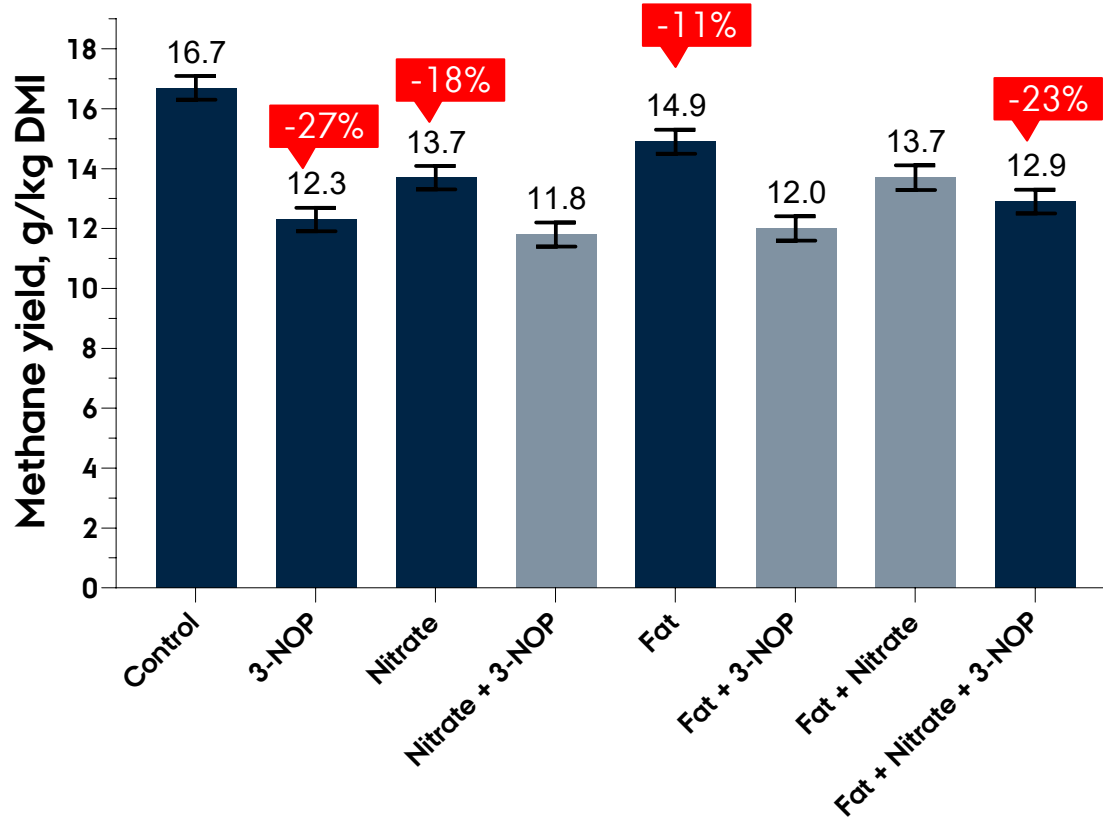
Palm kernel oil



MILK YIELD



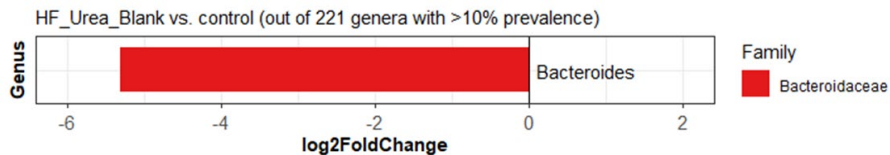
METHANE YIELD



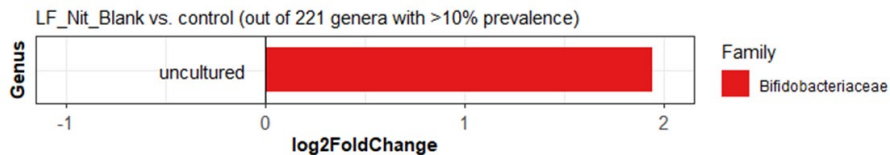
	P-value
Fat	0.35
Nitrate	<0.01
3-NOP	<0.01
Fat x Nitrate	<0.01
Fat x 3-NOP	<0.01
Nitrate x 3-NOP	<0.01
Fat x Nitrate x 3-NOP	0.58

RUMEN MICROBIOME

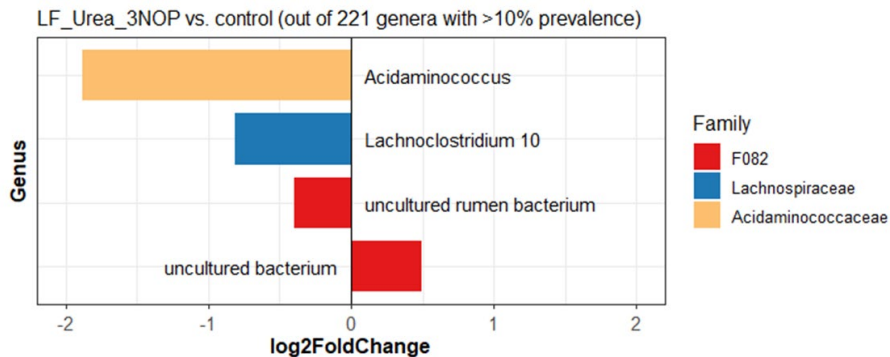
+ FAT



+ NITRATE

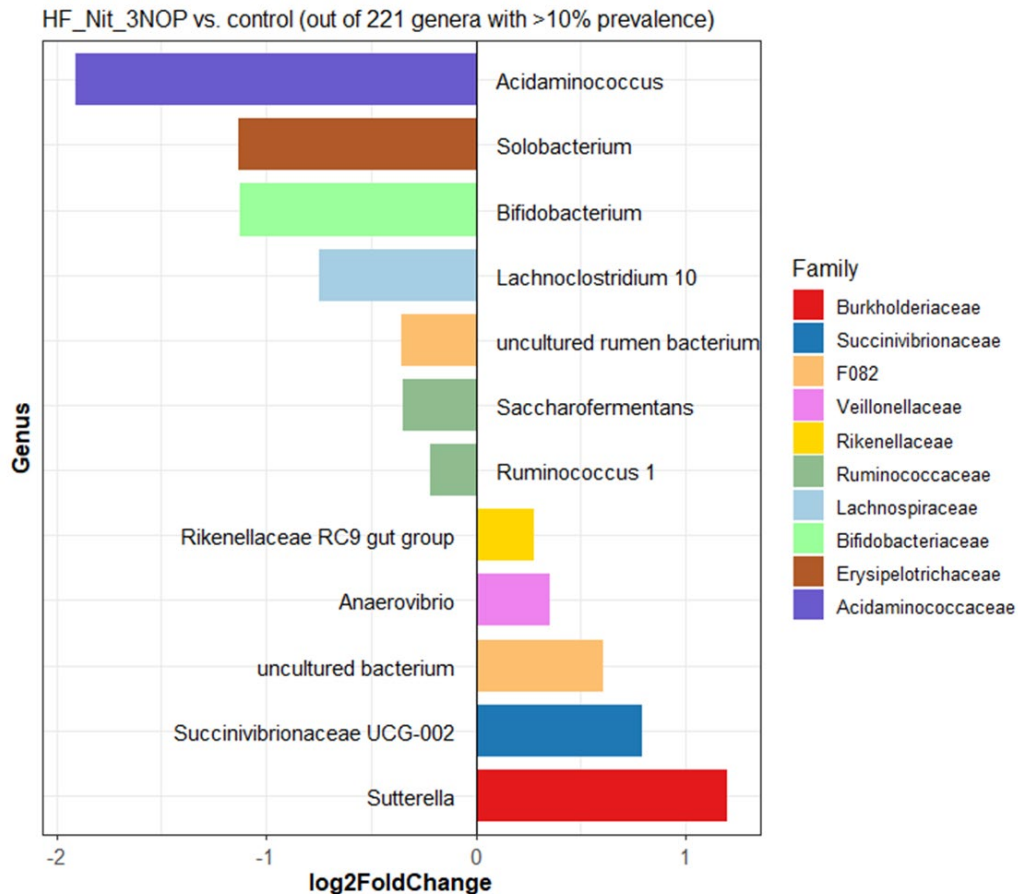


+ 3-NOP



RUMEN MICROBIOME

+ NITRATE
+ 3-NOP
+ FAT



IMPLEMENTATION

As of January 2025:

- Option 1: Increase the level of fatty acids in the diet to 48 g FA/kg DM
- Option 2: Use Bovaer (60 mg/kg DM) for 3 month per year

Full economical compensation for the first 2 years

Mandatory, except for organic farms and farms with less than 50 dairy cows



AARHUS
UNIVERSITET