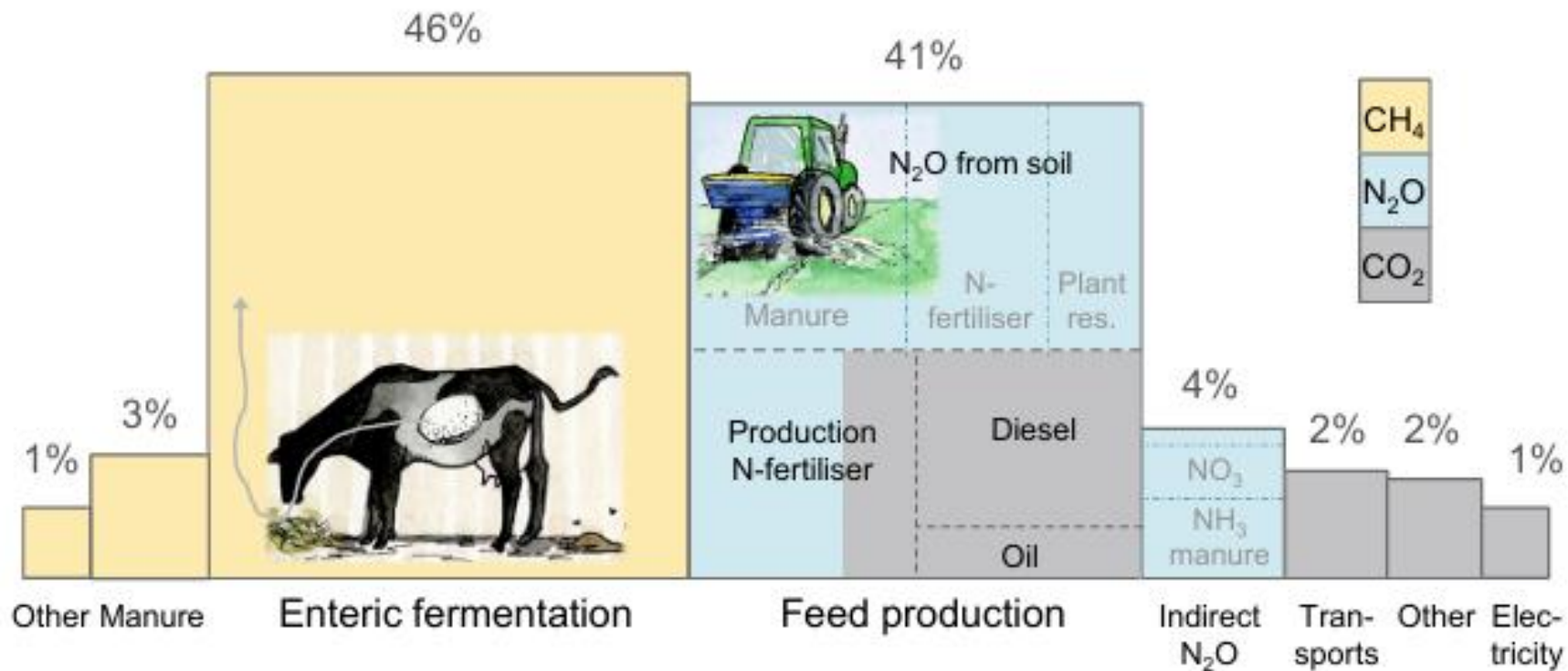




Metanproduktion från djurens fodersmätning

Johanna Karlsson, Växa Sverige
2026-03-12

**Är metan från fodersmältning något vi
behöver lägga kraft på?**

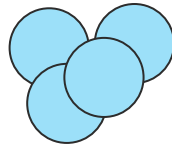
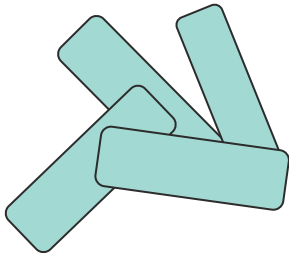


Henriksson, 2014

Metan (CH₄)

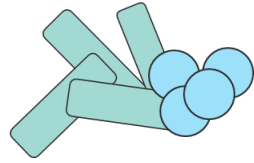
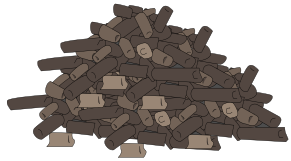
Bildas av metanogener

- Anaeroba arkéer (mikroorganismer som lever i syrefri miljö)
- CH₄ biprodukt från deras ämnesomsättning
- $\text{CO}_2 + 4 \text{H}_2 \rightarrow \text{CH}_4 + 2 \text{H}_2\text{O}$

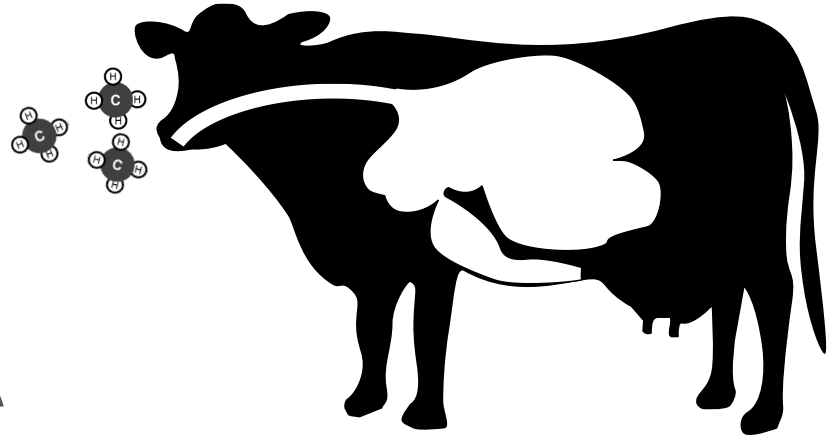
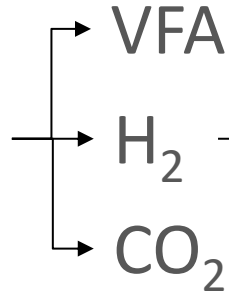




Foder

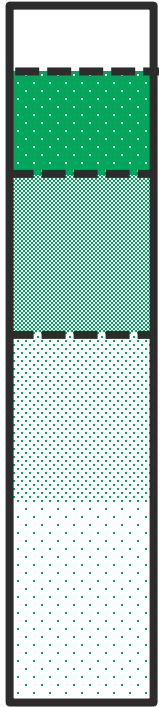


Mikrober
bryter ner



Metanogenes → CH₄

Zhao et al., 2020

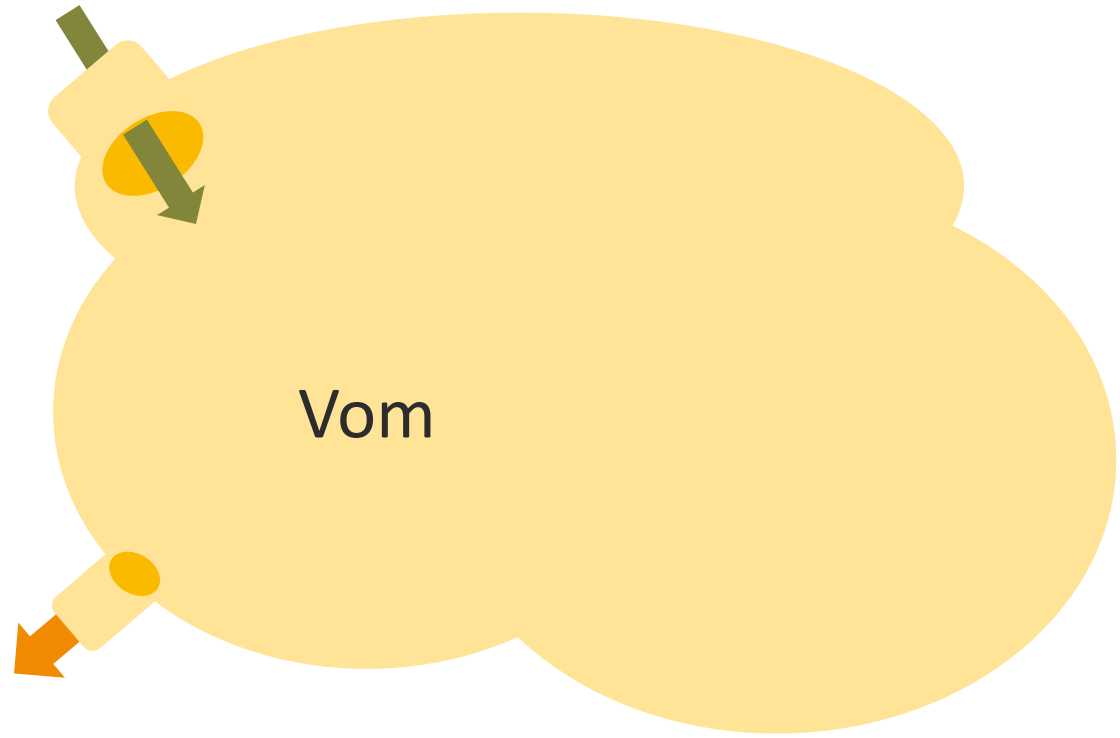


Gas

Fibermatta

Mellanzon

Vätskefas

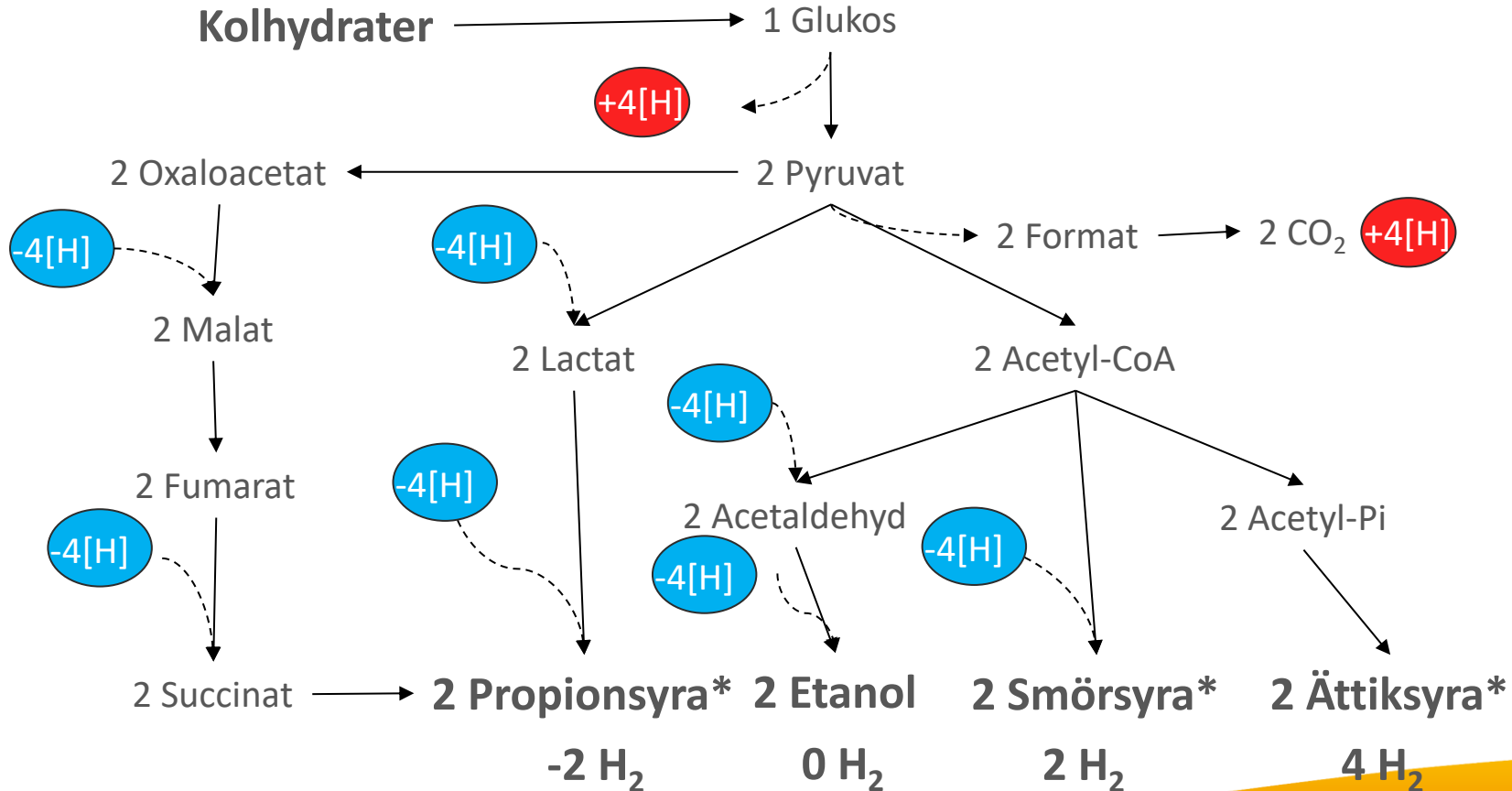


Vom

How Does a Rumen Work

<https://www.youtube.com/watch?v=muf8ZA3F2mA>

*VFA = flyktiga fettsyror



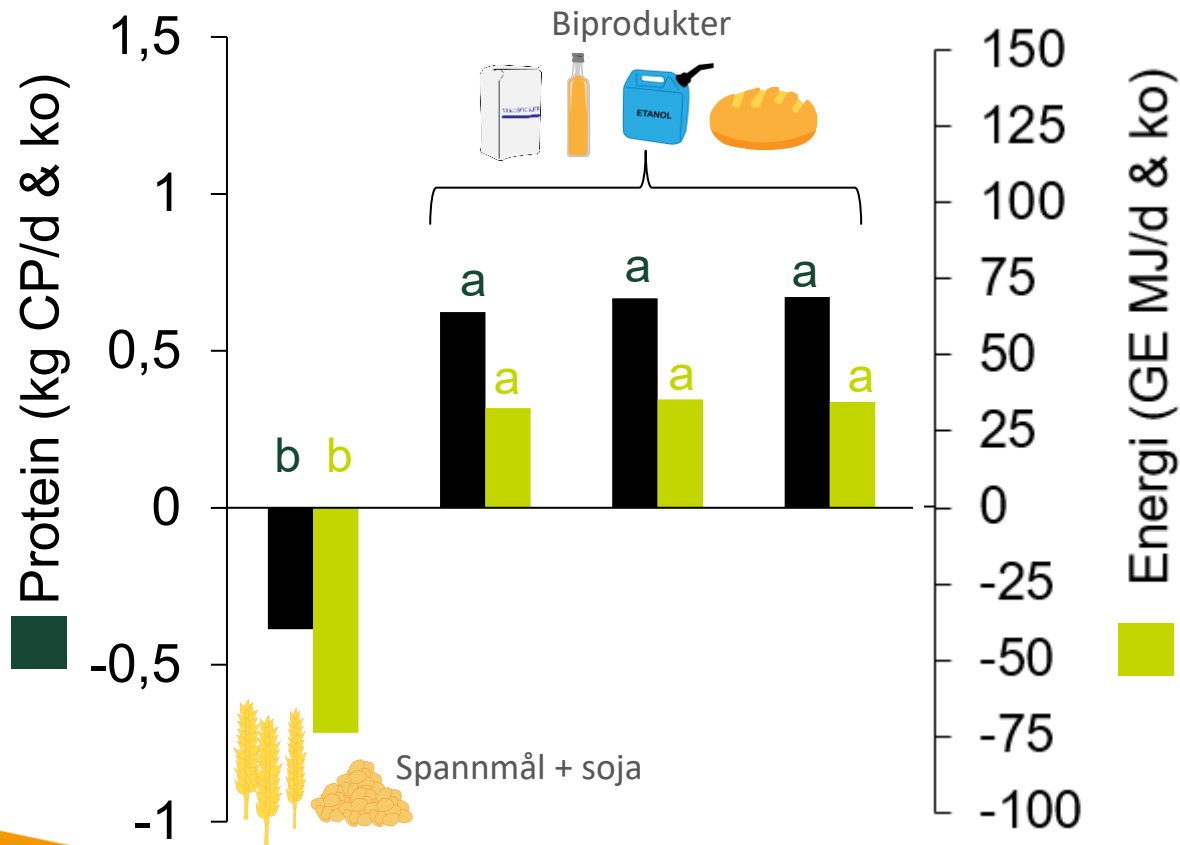
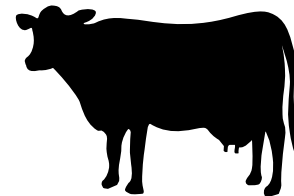
Moss et al., 2000; Wang et al., 2023

↑ stärkelse ↑ propionsyra ↓ metan

Sutton et al., 2003

Varför utfodrar vi inte bara idisslare stärkelsesrikt foder istället för grovfoder, så minskar vi metanproduktionen från fodersmältningen?

Nettoproduktion av livsmedel

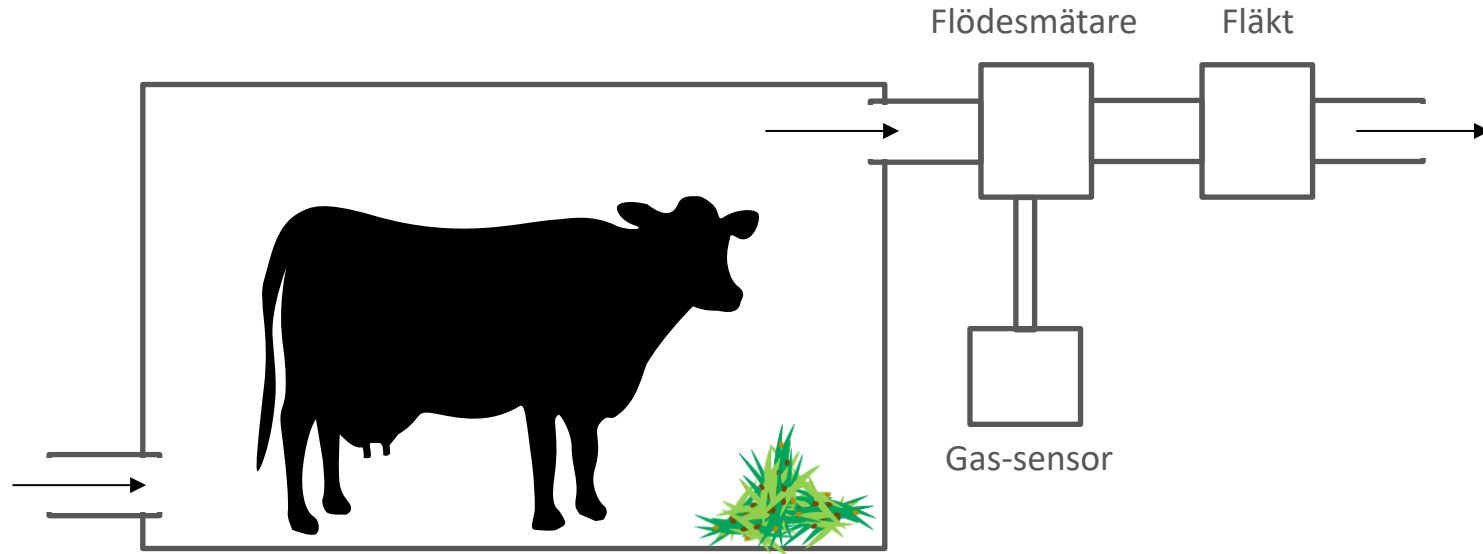


= producerat livsmedel –
utfodrat potentiellt
livsmedel

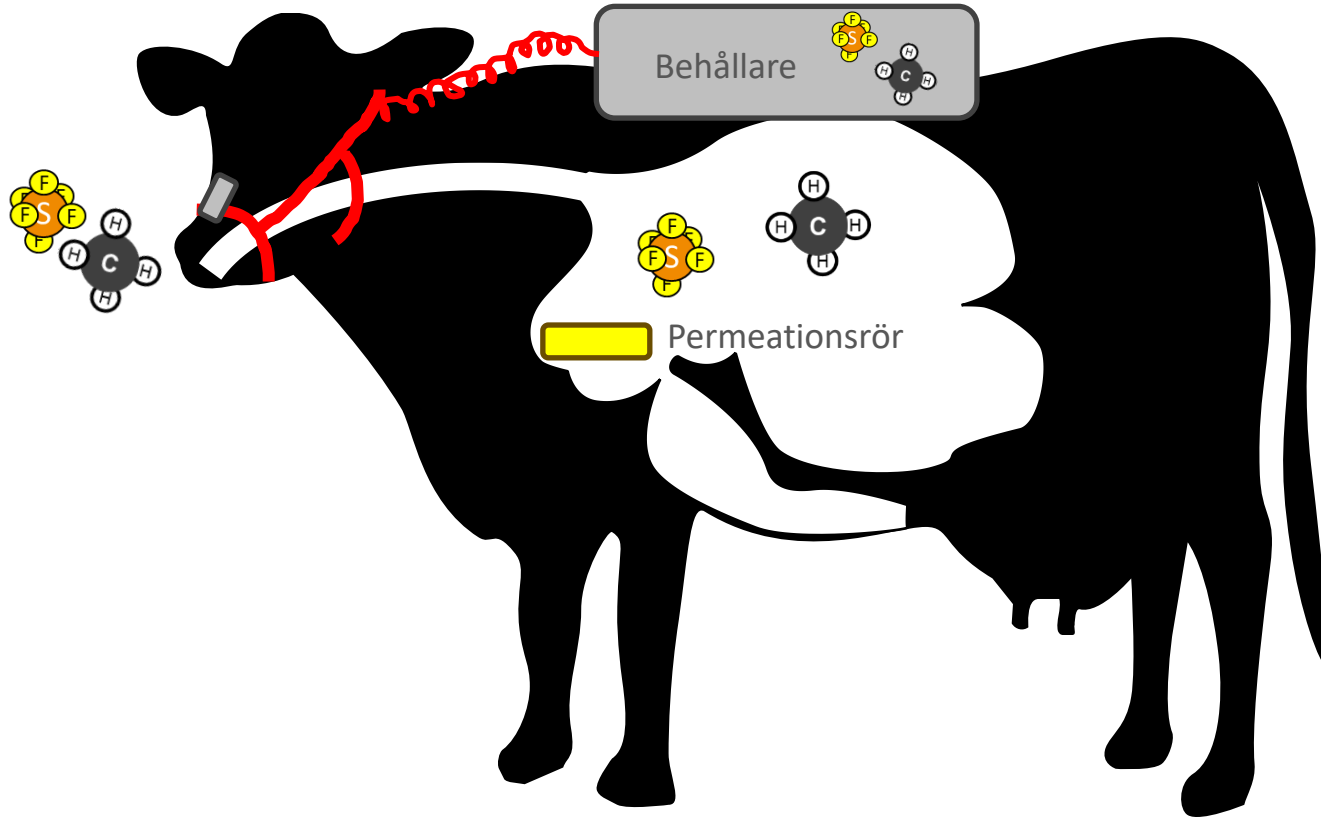
Mäta metan

- Respirationskammare
- SF6
- Sniffer
- GreenFeed
- Laser

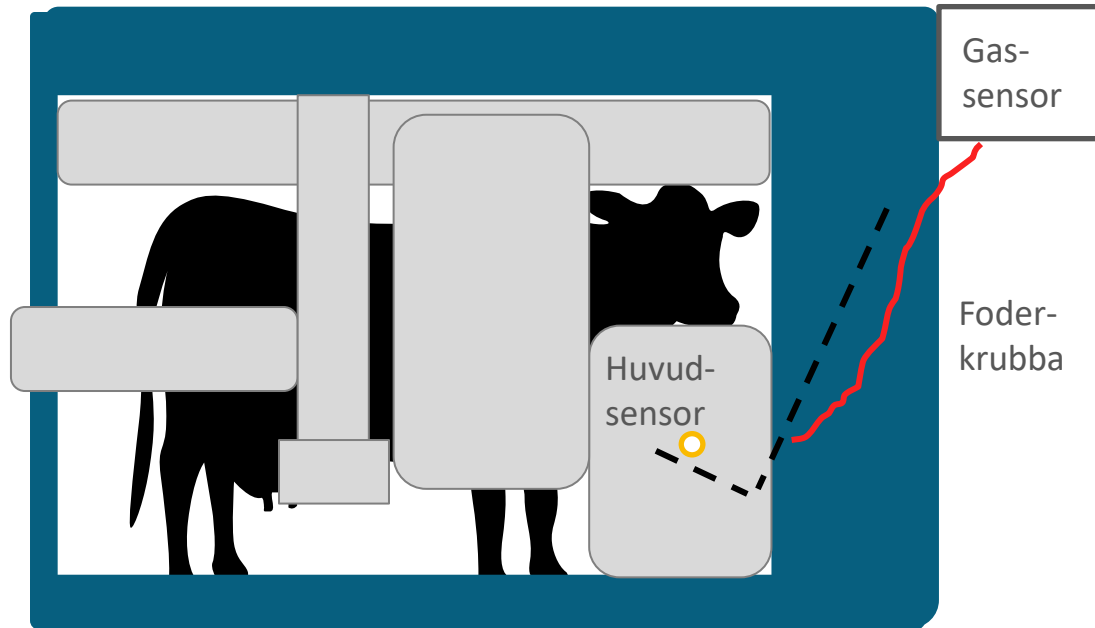
Respirationskammare



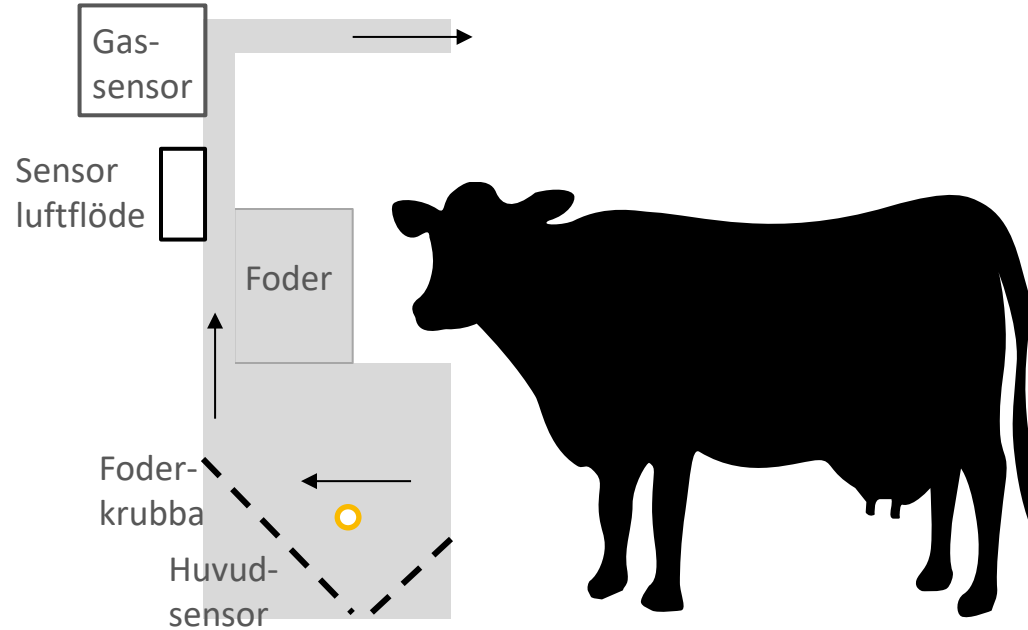
SF₆



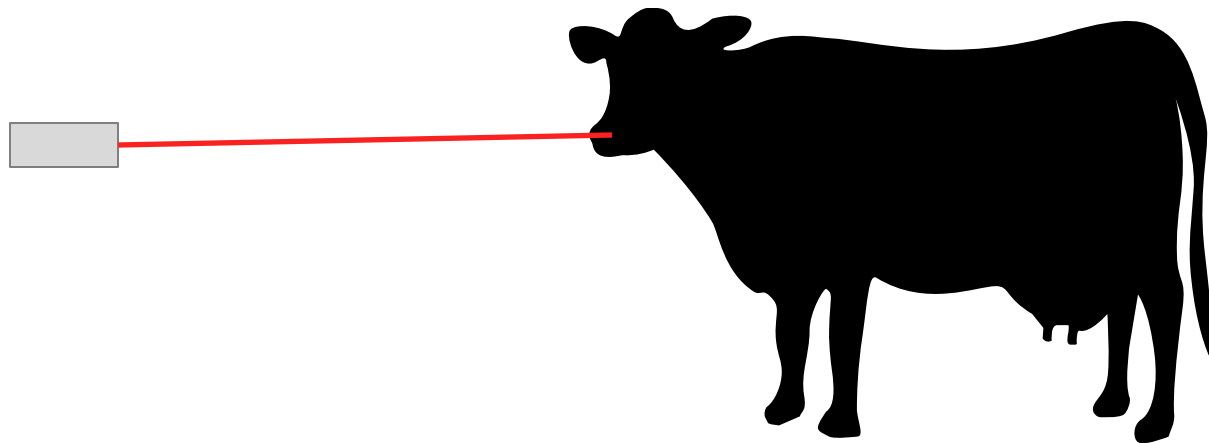
Sniffer



GeenFeed (huvudkammare)



Laser

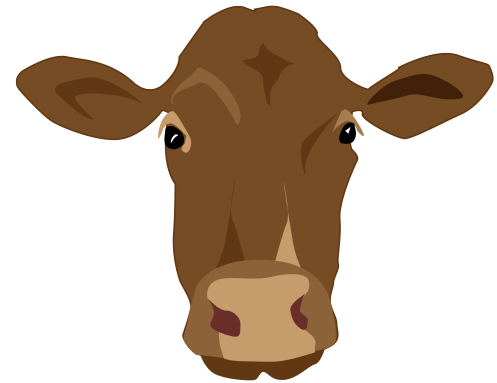


Mäta metan

Metod	Inköp	Drift	Underhåll	Påverkar beteende	Kapacitet (djurantal)	Mäter
Respirationskammare	Hög	Hög	Hög	Hög	Låg	CH ₄ , CO ₂ , H ₂ , O ₂
SF ₆	Mellan	Hög	Hög	Mellan	Mellan	CH ₄
Sniffer	Låg	Låg	Låg	Nej	Hög	CH ₄ , CO ₂ , (H ₂), O ₂
GreenFeed	Medium	Medium	Låg	Låg	Mellan	CH ₄ , CO ₂ , H ₂ , O ₂
Laser	Låg	Låg	Hög	Låg	Mellan	CH ₄

Avel för sänkt metanproduktion

- Forskning och utveckling pågår för avel på metaneffektivitet
- Holstein och SRB
- Mål: -25% metan på 25 år
- Bred och bestående effekt
- Inget merarbete för djurägare
- Avel mot ökad tillväxt, avkastning, fodereffektivitet, friskare djur och högre fertilitet har redan ökat klimateffektiviteten



Påverka metanproduktionen hos idisslare med foder

+ Torrsubstansintag

- Fett

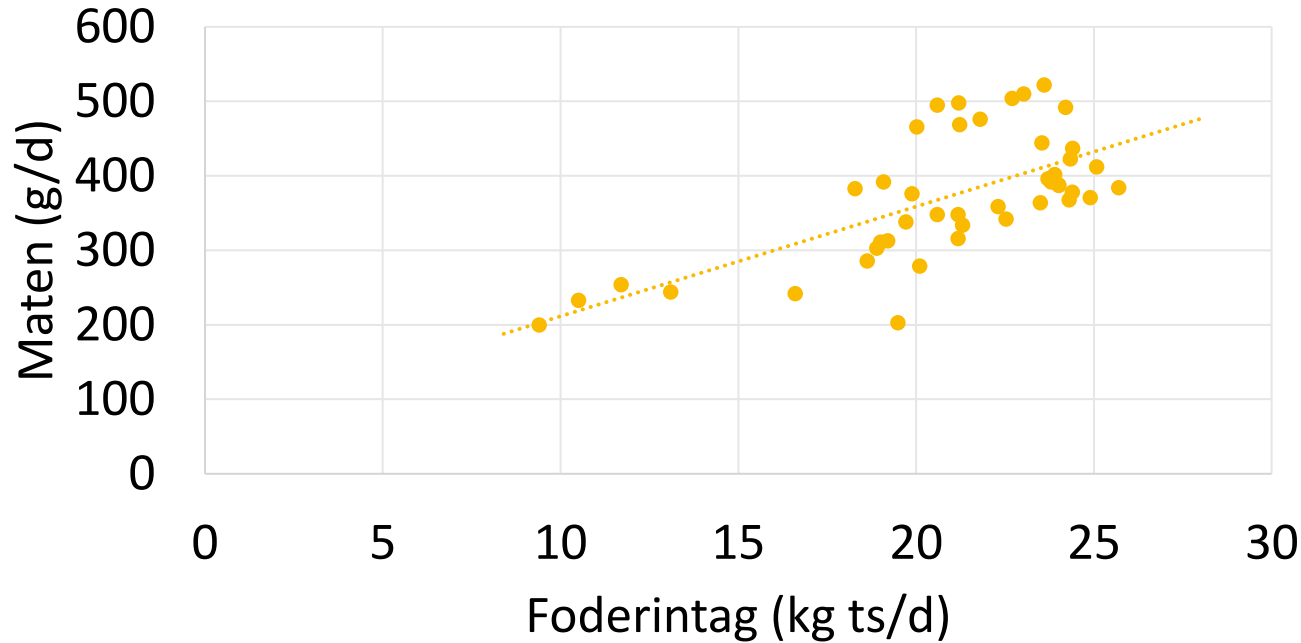
- Kraftfoder/stärkelse

+ Fibrer

- (Spätt)bete

<https://lantbruketskunskapsbank.se/mjolk/not/avancerad/minska-metan-med-foder>

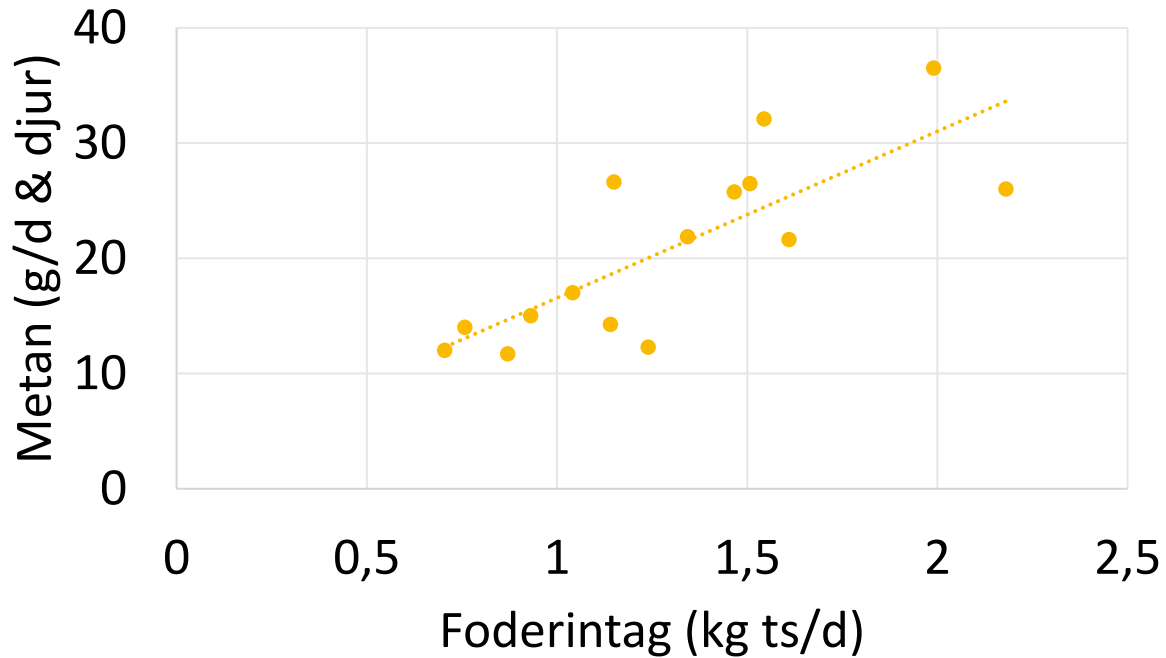
Mjölkkor



Ca 20 g CH₄/kg ts

Ca 450 g CH₄/d

Får



Ca 15 g CH₄/kg ts

Ca 25 g CH₄/d

Övriga tamdjur

Produktion av metan

- Grisar 1-2 g metan/d när väger mellan 60-90 kg (Ji et al., 2011)
- Hästar upp till 120 g metan/d (Jensen, 1996)
- Renar ca 8-11 g metan/d (Hansen et al., 2018)

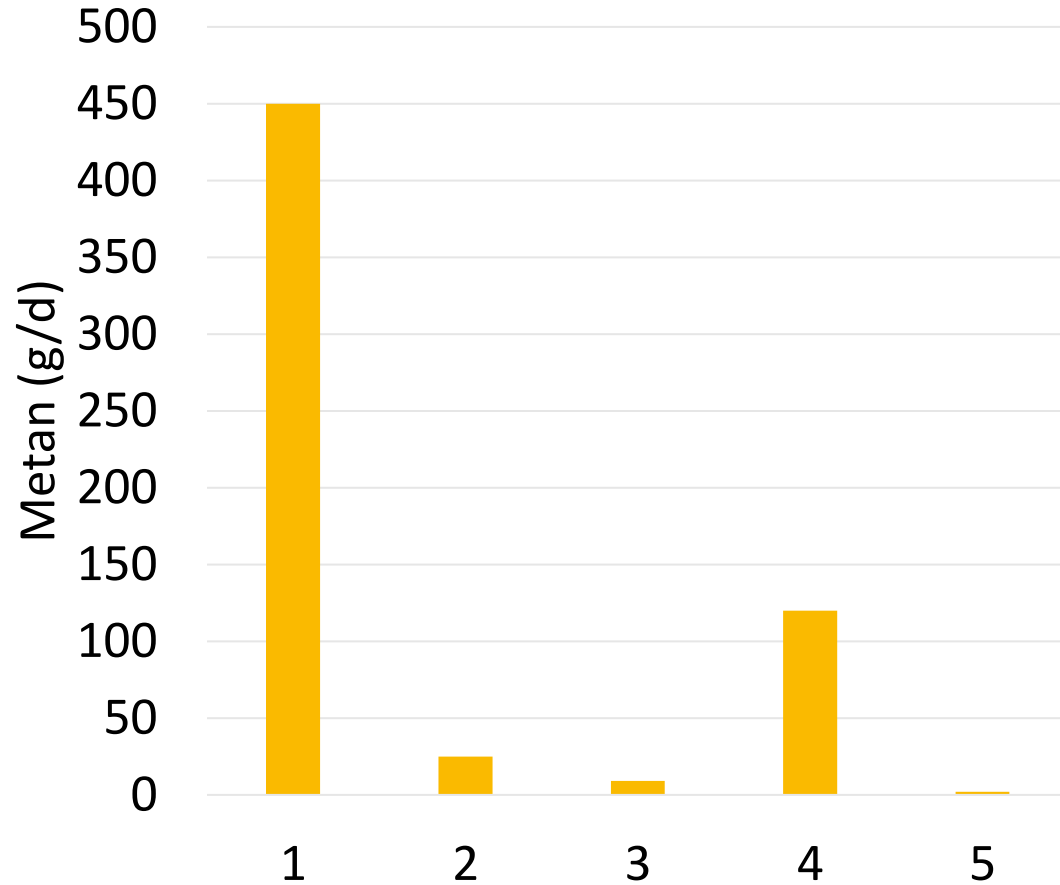
Metan från olika grupper tamdjur

EU	Ton CH ₄	%	Antal miljoner	Sverige	Ton CH ₄	%	Antal miljoner
Nötkreatur	6 200 000	86%	72	Nötkreatur	100 000	86%	1,4
Får & getter	790 000	11%	67	Får & getter	4 300	4%	0,5
Grisar	100 000	1,4%	132	Grisar	2 100	2%	1,3
Hästar	90 000	1,3%	6	Hästar & renar	9 300	8%	0,35* & 0,25**

EEA, Eurostat, Naturvårdsverket, Jordbruksverket

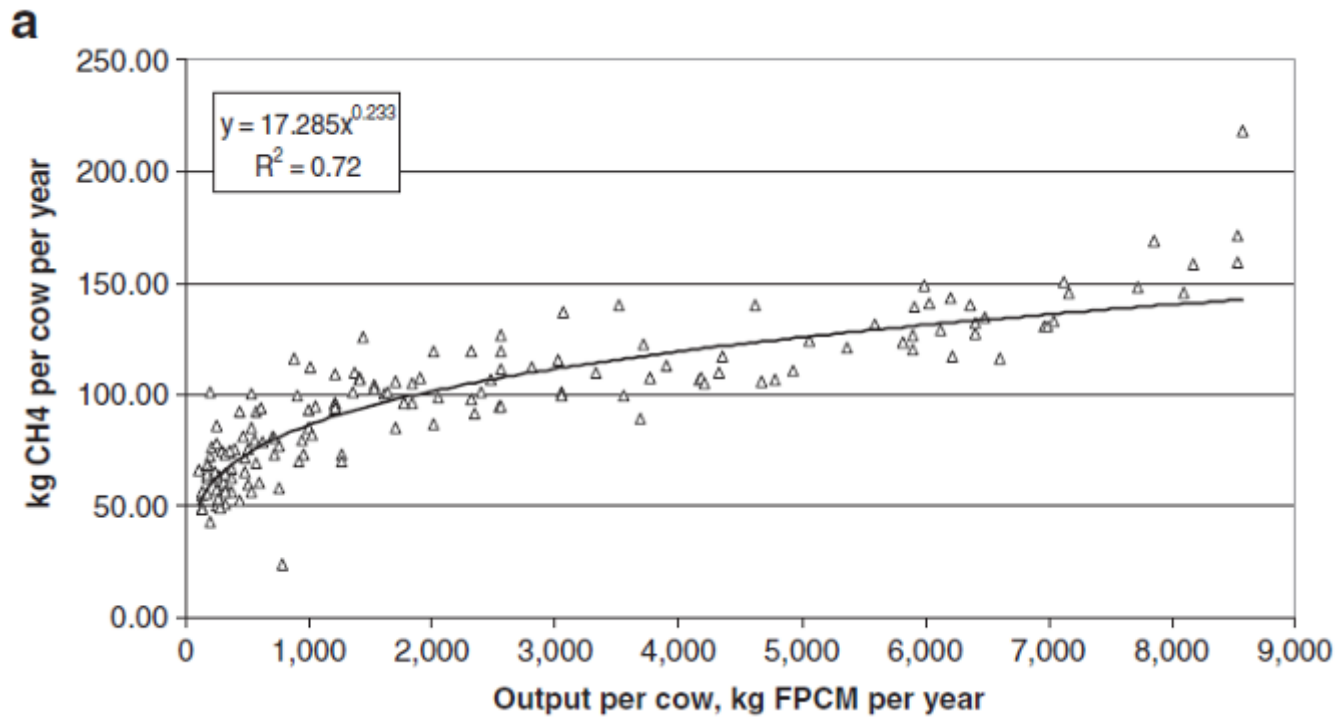
*SCB 2016, **SVA

Gissa djuret!

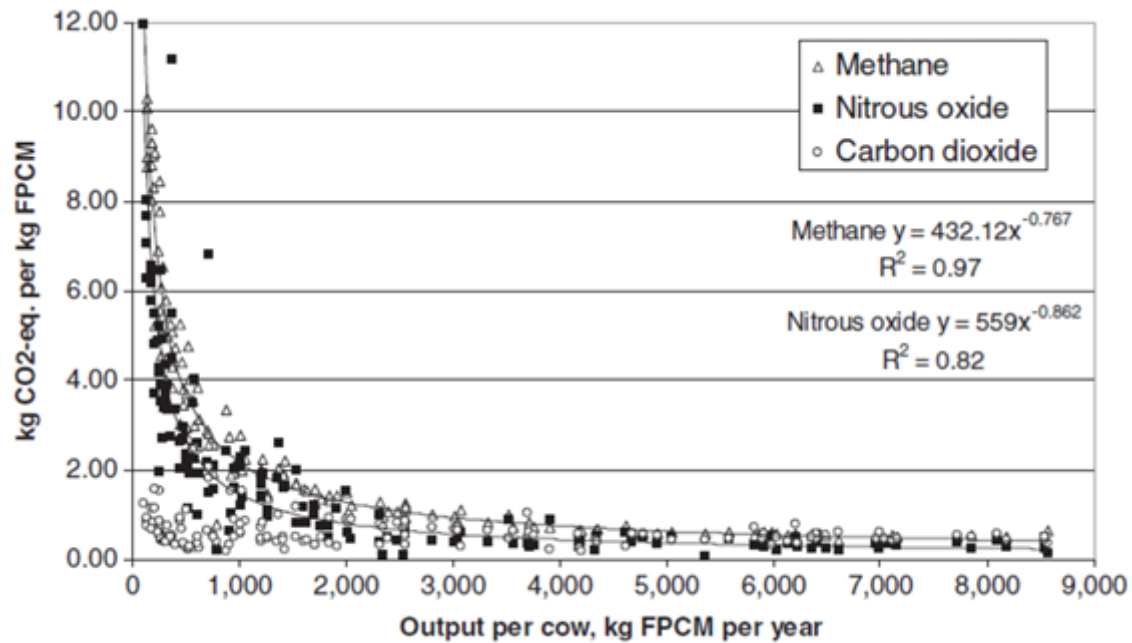


Metanmått

- **Metanproduktion** – g CH₄/dag & djur
- **Metanintensitet** – g CH₄/kg ECM eller g CH₄/kg slaktvikt
- **Metanavkastning** – g CH₄/kg ts foderintag



Gerber et al., 2011



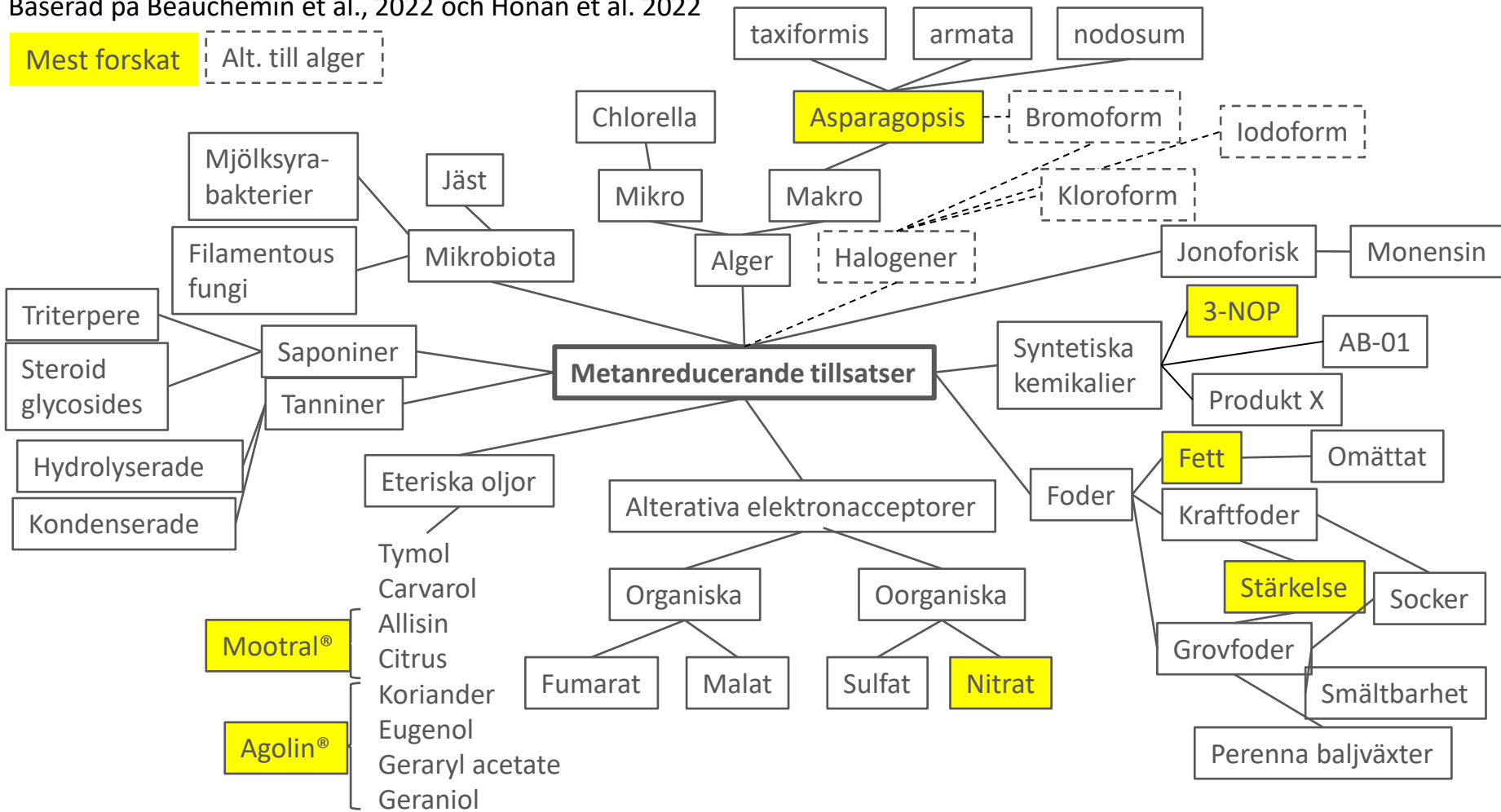
Gerber et al., 2011

Metanreducerande tillsatser

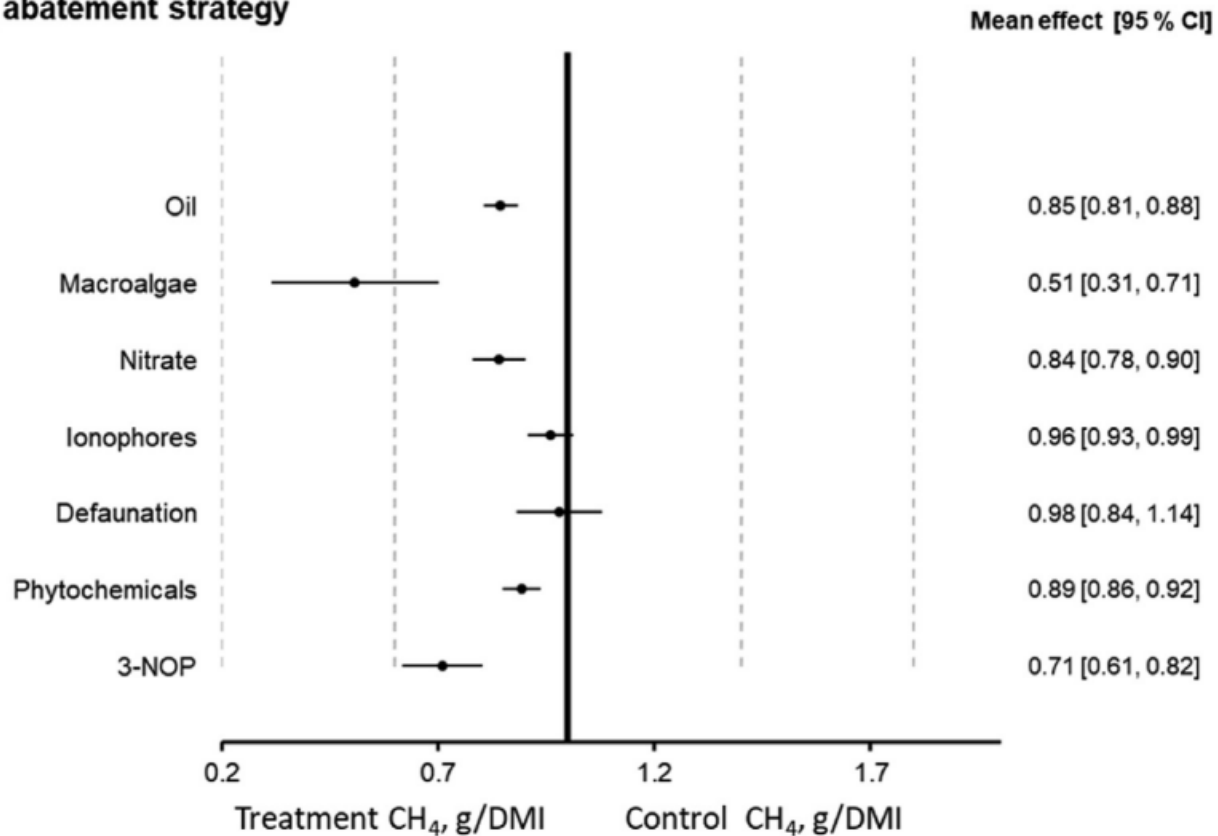
Baserad på Beauchemin et al., 2022 och Honan et al. 2022

Mest forskat

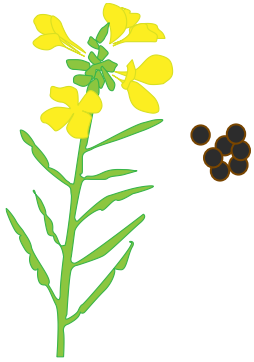
Alt. till alger



CH₄ abatement strategy



Tillsatt fett



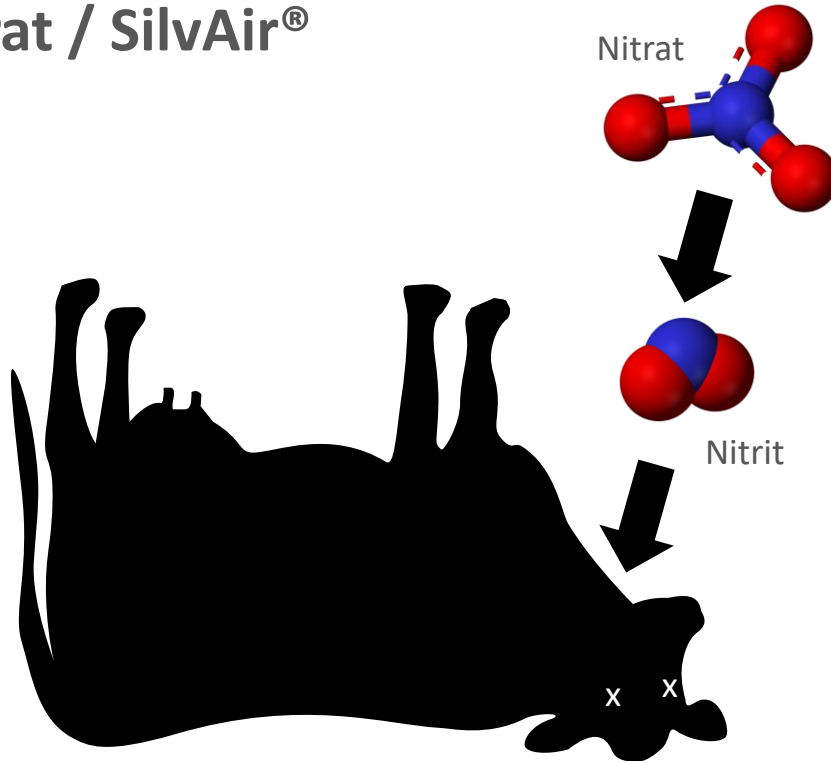
- Fett giftigt för metanogener och protozoer
- Minskar CH_4 med ca 3-5% för varje 10 g/kg ts
- Större effekt med omättat fett
- Max 50 g råfett/kg ts (hämmer fibersmältbarhet)
- Vomskyddat fett påverkar inte vommikroberna

Eteriska oljor



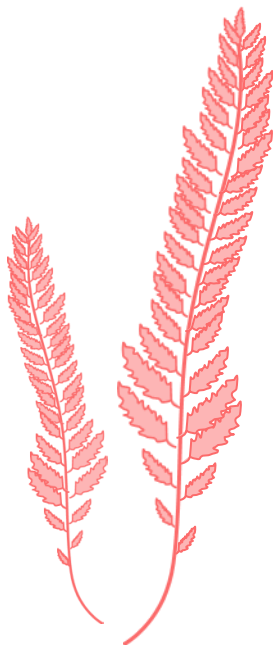
- Vissa antimikrobiella
- Ca 1 g eterisk olja/kg ts
- Minskar CH₄ ca 9%
(osäkra resultat med djur)
- Ev. smak mjölk/kött

Nitrat / SilvAir®



- Drar elektroner från metanbildningen
- Sänker CH₄ med ca 10%
- Utfodras ca 10 g/kg ts
- Nitrat → nitrit → ammoniak
- Nitrit giftigt - reagerar med hemoglobin
- Kräver långsam tillvänjning

Rödalger – *Asparagopsis taxiformis*



- Aktiv substans bromoform (CHBr_3)
- Hämmar ett enzym i sista steget av metanbildning
- 3-51 mg CHBr_3 /kg ts
- Ca 0,1% av organisk substans i foderstat
- Minskar CH_4 med 9-98% (medel 35%)
- Jod & brom i mjölk

Table 3. Levels of bromoform (CHBr₃) in milk, urine, and feces of the dairy cows on different days relative to the first day of offering seaweed mix containing *A. taxiformis*. Averages are calculated based on values above the detection limit, otherwise, the detection limit is given.

	Day	Treatments		
		Low	Medium	High
CHBr ₃ Milk (µg/L)	-2	<5	<5	<5
	-1	<5	<5	<5
	1	9.1 ¹	11	<5
	9	<5	<5	35 ²
	10	<5	<5	<5
	17	<5 ³	<5 ³	<5 ³
CHBr ₃ Urine (µg/L)	-2	<1	<1	<1
	-1	<1	<1	<1
	1	10	50	114
	10	89 ⁴	148	127
	17	<2 ^{3,5}	<2 ^{3,5}	<2 ^{3,5}
CHBr ₃ Feces (µg/kg)	-2	<20	<20	<20
	-1	<20	<20	<20
	1	<20	<20	<20
	10	<20	<20	<20
	17	<20	<20	<20

¹ Value based on five out of eight animals. ² Only the milk of cow H1 was above the detection limit. ³ None of the values were above the detection limit, even for animals still receiving seaweed. ⁴ Values ranged from 6–267 µg/L.

⁵ Due to reduced retrieval of the internal standard, the detection limit was 2 µg/L.



Table 3. Concentration of iodine, bromide, and bromoform (CHBr_3) in milk of dairy cows fed a control diet or a diet supplemented with *Asparagopsis taxiformis* in experiment 3¹

Item	Treatment ²		SEM	P-value
	Control	HighAT		
Iodine, ng/mL	575	2,966	152.5	<0.001
Bromide, mg/kg	5.1 ³	40.4	2.64	<0.001
Bromoform, $\mu\text{g/L}$	16.5	28.9	10.62	0.44

¹Data presented are from samples composited by cow and then by treatment within each experimental period (n = 8, where n represents number of observations used in the statistical analysis).

²Control = basal diet; HighAT = basal diet plus 0.50% *Asparagopsis taxiformis* included on a DM basis.

³Bromide concentration in 3 out of 4 control samples was below the detection limit of the analytical procedure (4 mg/kg), and these were included in the statistical analysis as 4 mg/kg.

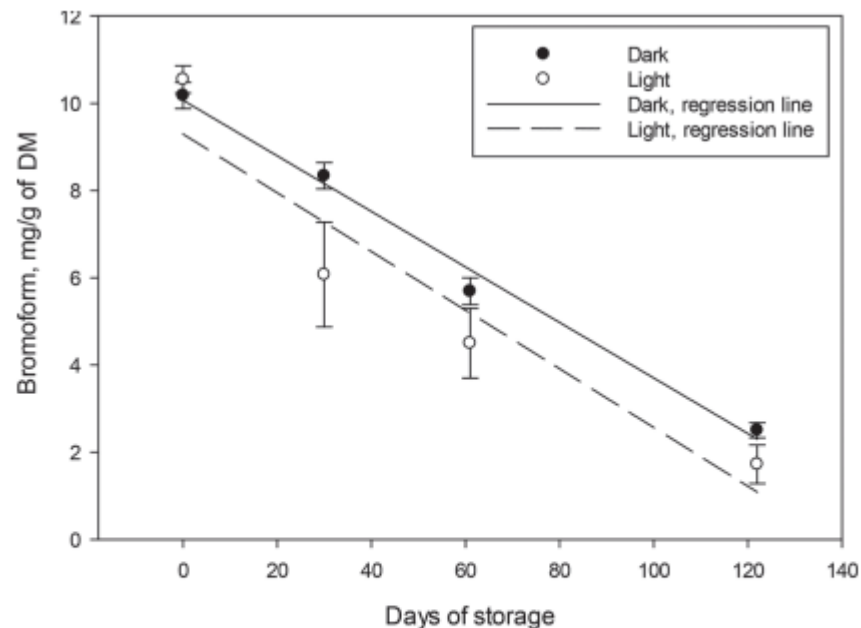


Figure 3. Effect of storage conditions and storage time on concentration of bromoform (CHBr_3) in *Asparagopsis taxiformis* (experiment 4; data are mean \pm SE). Light = seaweed material exposed to continuous fluorescent light; Dark = seaweed material stored in brown glass bottles with plastic lids.

3-NOP / tri-nitrooxypropanol / Bovaer[®]



- 10% 3-NOP i Bovaer[®]
- Minskar CH₄ med ca 20-35%
- 60 mg 3-NOP/kg ts (ca 15 g/ko & d)
- För högt intag minskar foderintag
- Blandas i bland/fullfoder via mineraler/kraftfoder

3-NOP / tri-nitrooxypropanol / Bovaer[®] forts.

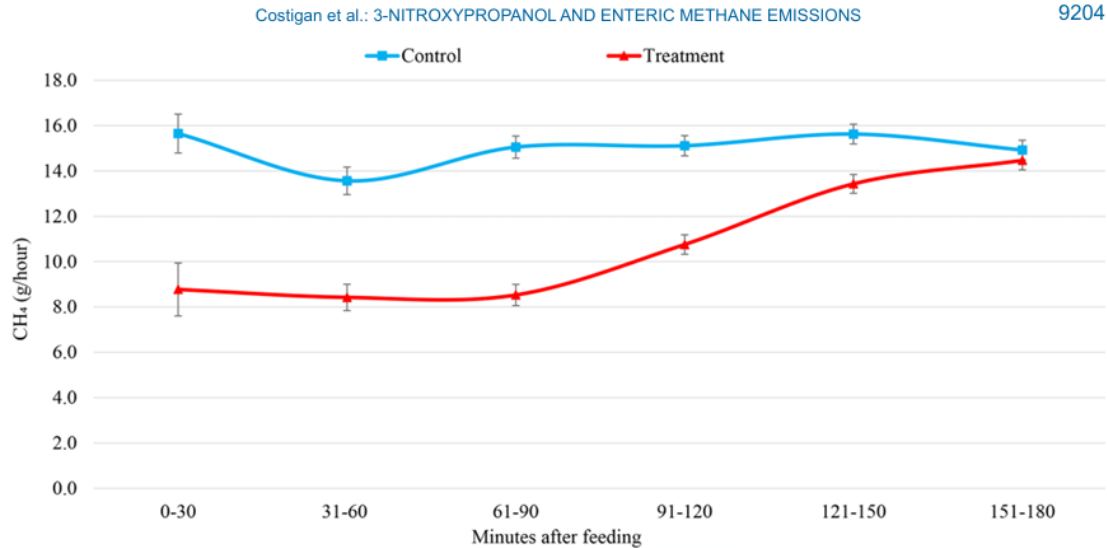
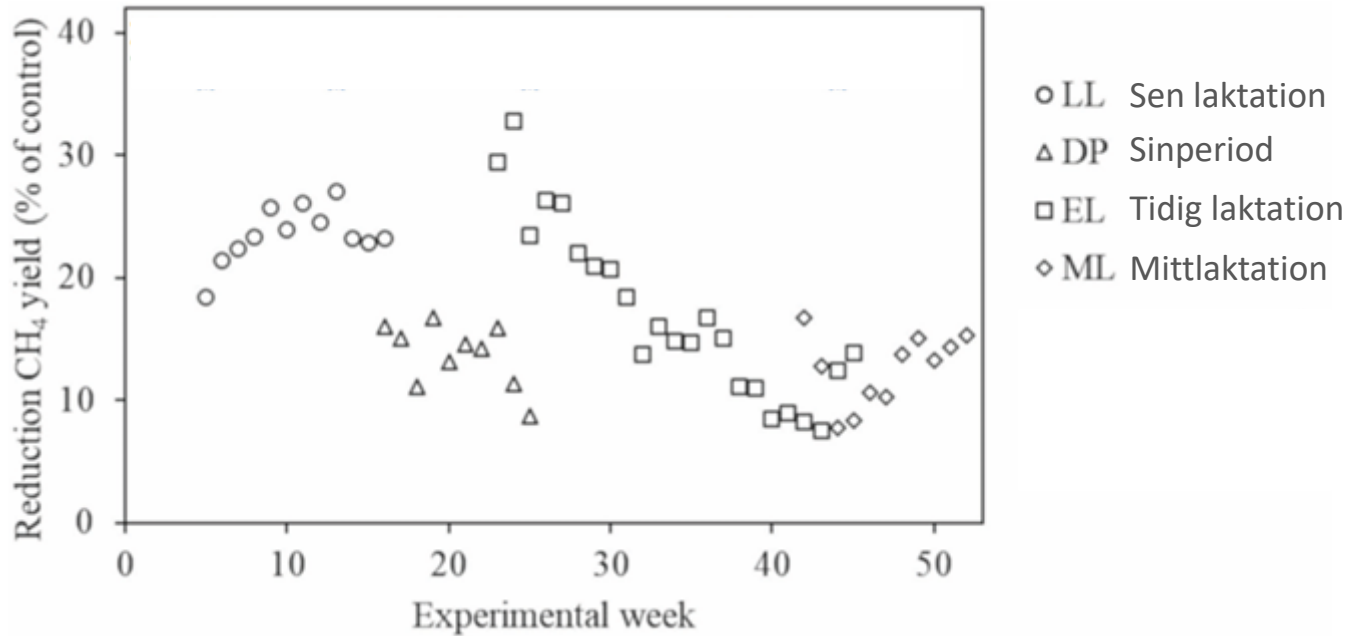


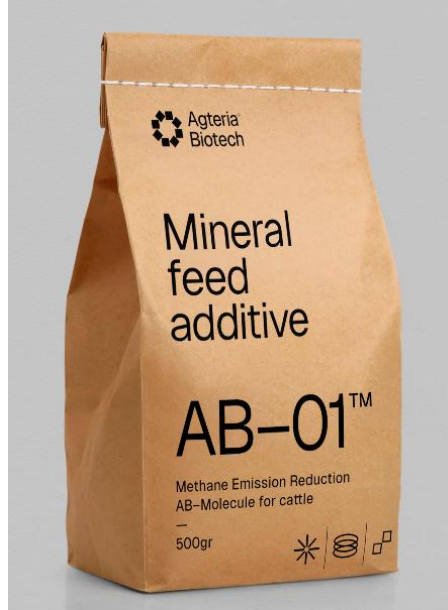
Figure 3. Least squares means (SE bar represents ± 1 SE unit) of the spot measurements of enteric CH_4 emissions in grazing dairy cows supplemented with 3-NOP twice daily (treatment) and cows without 3-NOP supplementation (control) in the 3-h period following additive feeding.

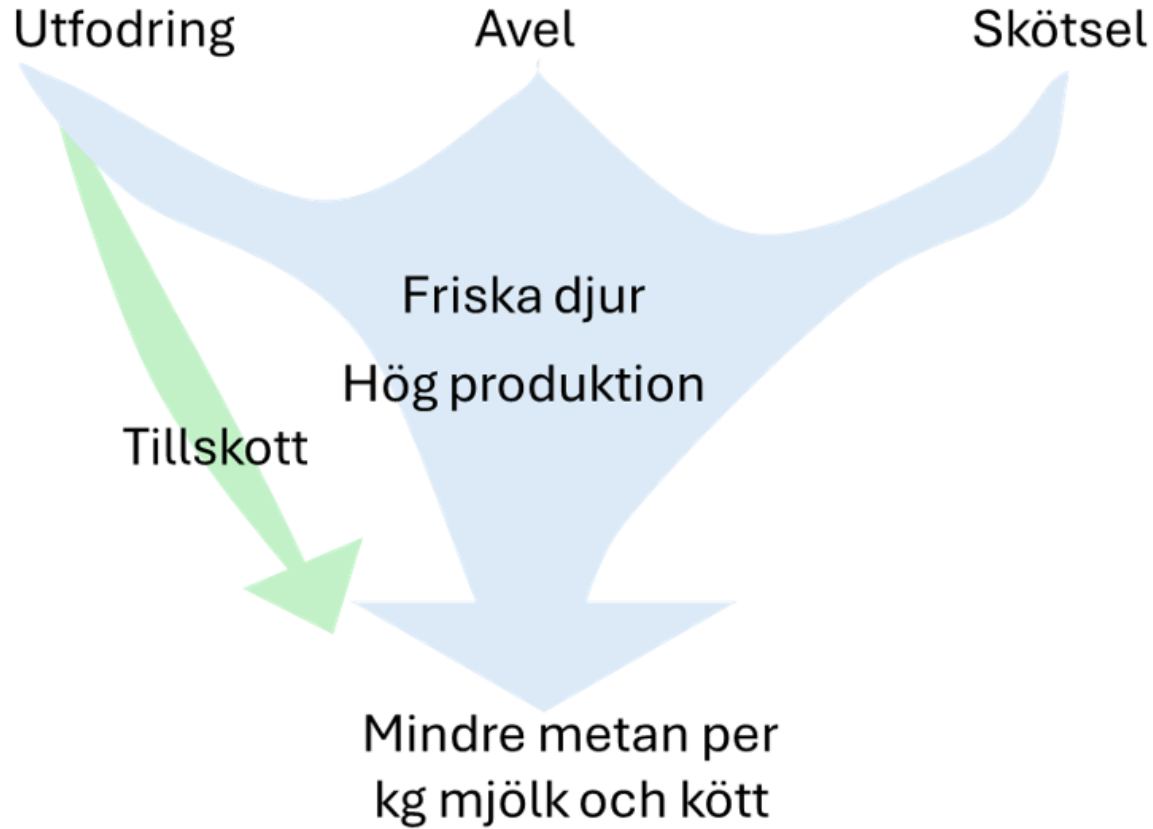
- Bryts ner inom ca 2 h
- 90+ forskningsstudier
- Flesta fokus metan och produktion



van Gastelen et al., 2024

Svenska start-ups







VÄXA

Besök oss på: www.vxa.se

johanna.karlsson@vxa.se