Using feed components in early life for long-term methane reduction in dairy cattle: preliminary results

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Study day “Methane in cattle husbandry”
October 6th, 2016

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Introduction

methane

Methane reduction in agriculture

Ruminants

Nutritional intervention

"Early Life Programming"

Postnatal intervention

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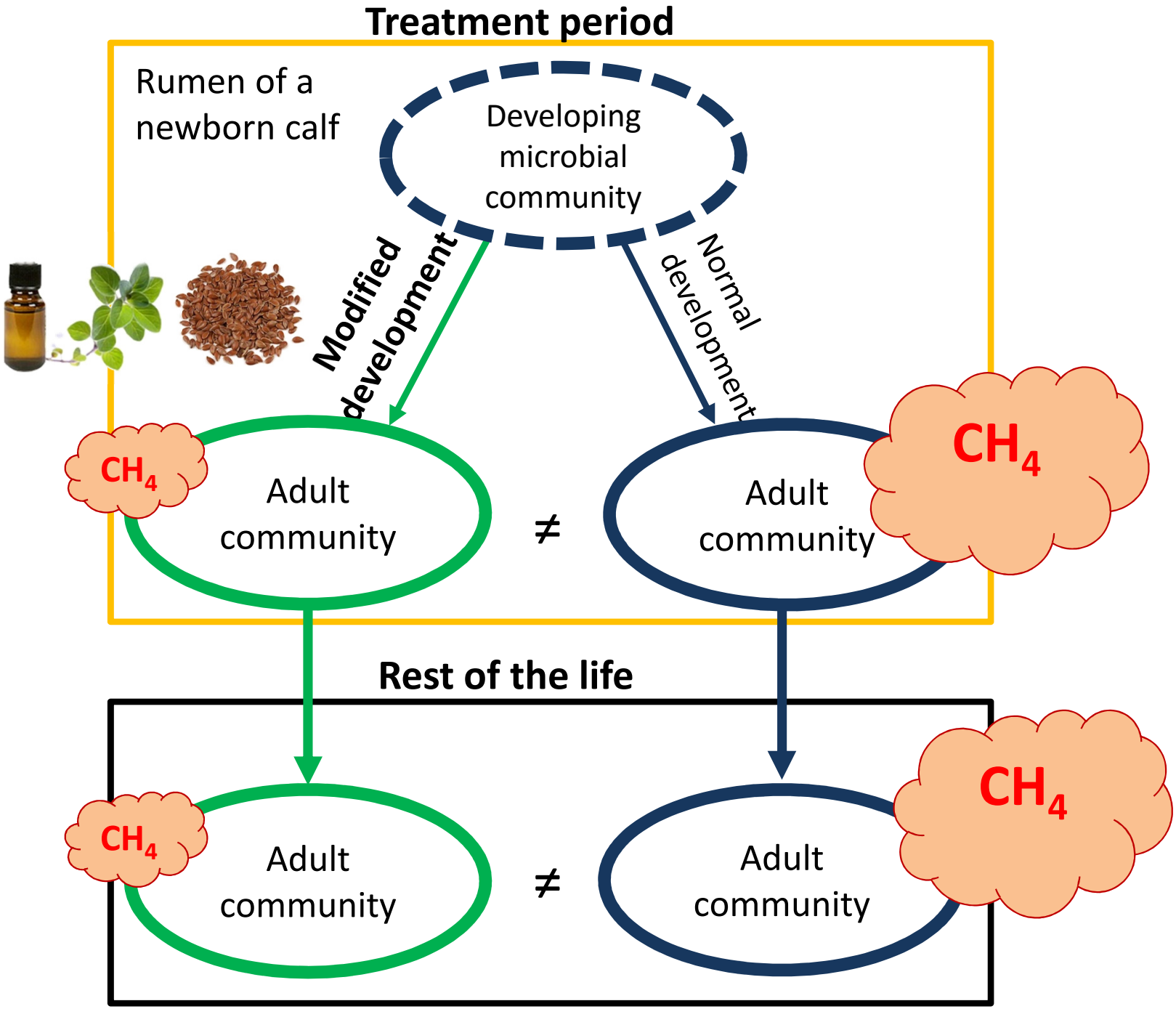
Hypothesis Early life programming



Experimental set-up

Control (**CON**, n=12)

Extruded linseed (**LIN**, n=11)

Ess. oils mixture (**ESS**, n=11)

Treatment	**No treatment**
birth	4 mo	1 month after calving
individually	*groups*	

Extruded linseed
4% C18:2
14% C18:3
Starting dose: 2x 11g/d, raised until 289g/d

Essential oil blend:
2x 0,25g/d (20% active compounds: mainly coriander oil, geranyl acetate, eugenol)

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Extruded linseed crumble (AVEVE)

- DOSE
  - Based on literature (Martin et al. 2008: 212g/kg DM for 38% CH_4 reduction)
  - Recalculated according to theoretical rumen volume of adult → calf
  - Dose rises with supposed rumen volume increase: from 2x11g/d to 2x 289g/d

- METHOD OF SUPPLEMENTATION (**proof of principle**)
  - From birth until weaning (ca. 8 weeks):
    - Dose mixed with little milk to form small bolus
    - Given by hand into mouth of calf (2x/day)

  - From weaning until 16 weeks: crumble on top of normal concentrate (2x/day)

Essential oil blend (Agolin)

- DOSE
  - Based on <u>producer's instructions</u>:
    - Adult cow: 1 g/day → **calf: 0,5 g/day**
  - <u>Same dose</u> for whole treatment period

- METHOD OF SUPPLEMENTATION
  - <u>From birth until weaning</u>: gelatin capsule (2x/day)

  - <u>From weaning until 16 weeks:</u>
    EO product mixed in separate concentrate (0,7% DM)

Methane emissions

- **Methane emissions measured in open circuit chambers**

- At 4, 6, 12 and 18 months old

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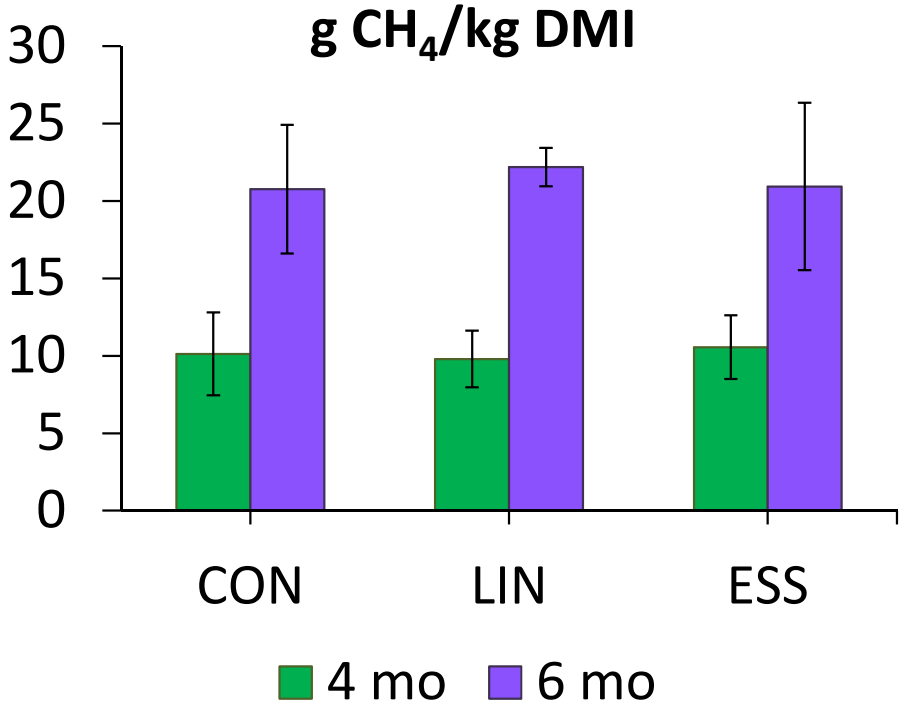
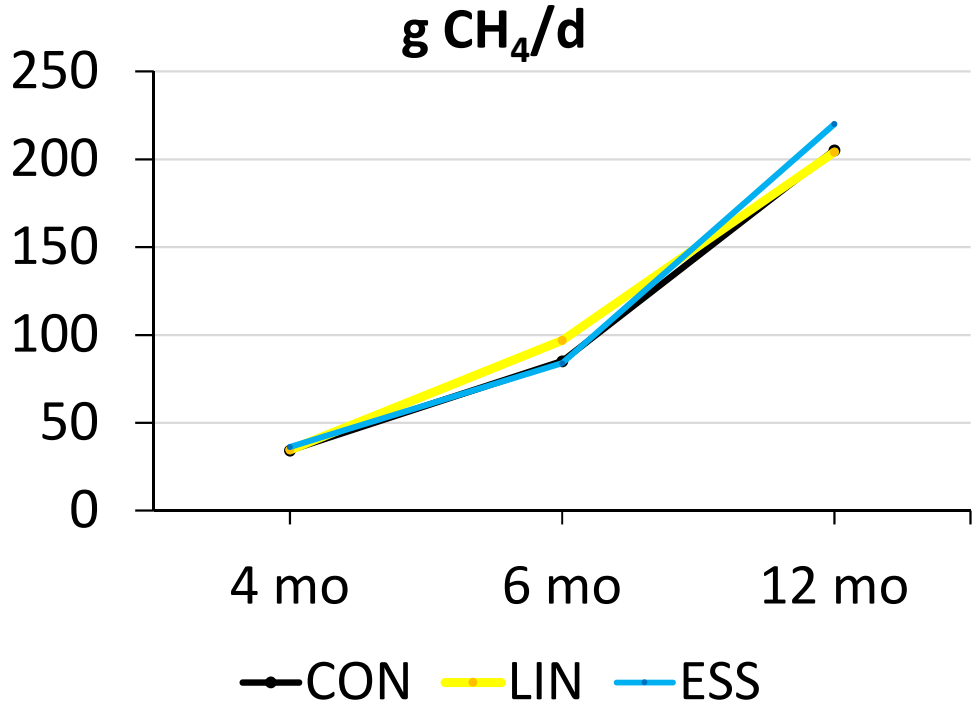
Methane emissions

- **Methane emissions expressed as**:
  g CH_4/d, g CH_4/kg DMI, g CH_4/kg BW, g CH_4/kg $BW^{0,75}$
  - No effects at 4 months old (end of treatment period)
  - No effects at 6 months old (programming, 2 months after treatment)
  - No effects at one year old (programming, 8 months after treatment)
  - 18 months: results pending





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Results: feed intake

- DMI and feed conversion efficiency (no differences)

Item	CON (n=12)	LIN (n=11)	ESS (n=11)	p-value
Total DMI (kg)				
Until weaning	55.1	60.3	55.8	0.294
Until end treatment	222	249	243	0.243
Until 6 months	408	452	445	0.188
Feed conversion efficiency (kg DMI/kg growth)				
Until weaning	1.97	1.87	1.77	0.342
Until ca. 4 months	2.57	2.51	2.58	0.723
Until 6 months	3.26	3.28	3.20	0.920

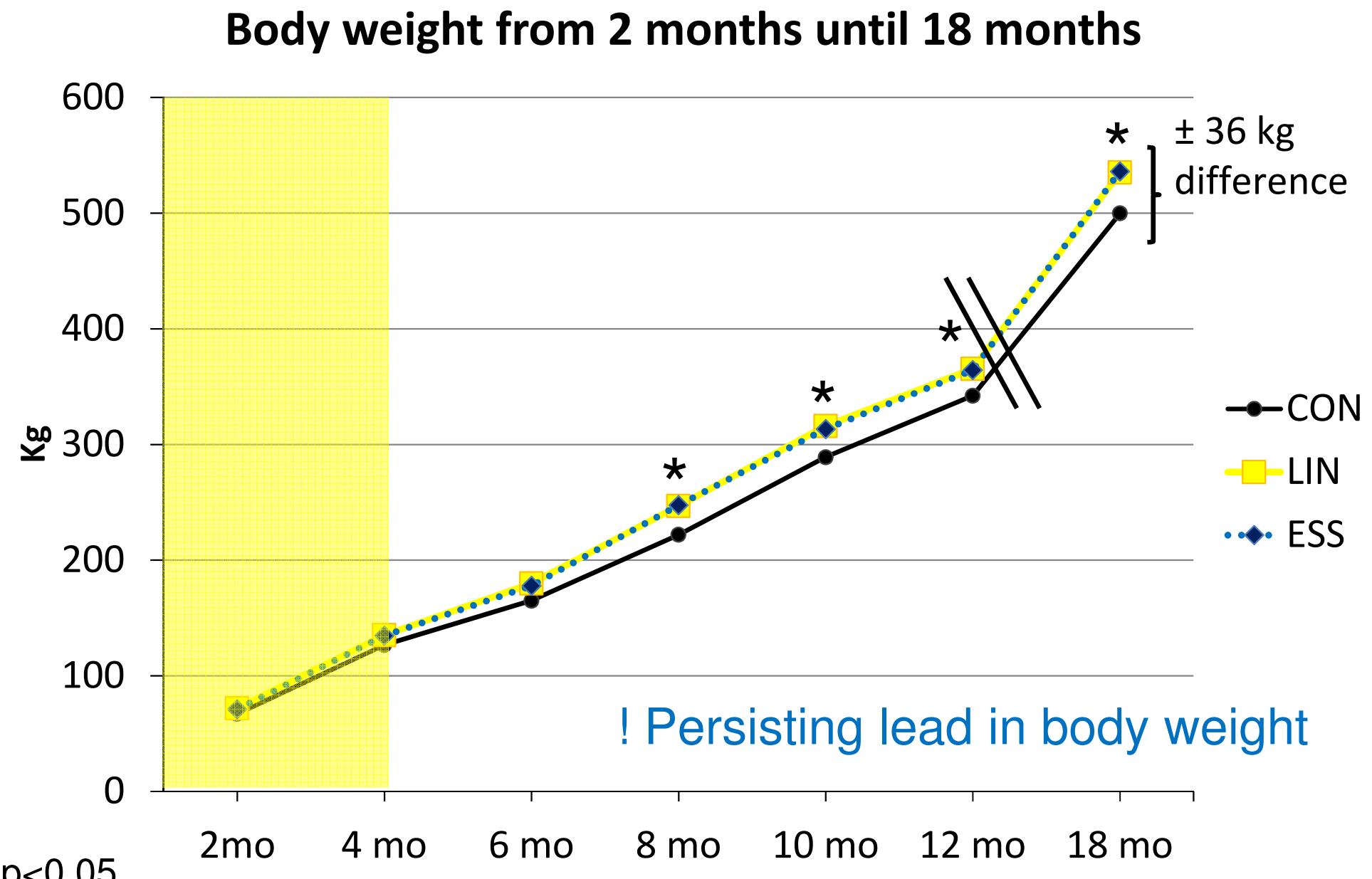
Results: body weight and daily growth

- Until 6 months old

Item	CON (n=12)	LIN (n=11)	ESS (n=11)	p-value
Daily growth (kg/day)				
Until weaning (ca. 8 wk)	0.500[b]	0.581[a]	0.570[a]	0.048
Until 4 months	0.726[b]	0.816[a]	0.807[a]	0.033
From 4 to 6 months°	0.662	0.726	0.710	0.874
Weight (kg)				
Weaning	67.0	71.9	71.1	0.115
4 months	127	135	135	0.211
6 months	165	180	178	0.058

* 0,01< p < 0,05 °change of ration (grass and maize silage, concentrates)

Results: growth



* p<0,05

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Results: growth

- Because of higher body weight at same age: **earlier first insemination** (min. weight 425 kg)

	CON	LIN	ESS	SEM	P value
Age at first insemination (months)	15,7[a]	14,7[b]	14,7[b]	0,200	0,052

- **Milk production starts one month earlier**
  - One month less CH_4 emissions from youngstock
  - 7% less abs. CH_4 emissions in youngstock period

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Discussion growth and DMI

- Better daily growth until 4 months old

  → Although no difference in DMI

- From 6 months old: higher body weight

  → Effect persists! (without treatment)

- **A better growth in the first months of life is positively associated with future milk production (Bach, 2012)**

  A. Before weaning

  → higher milk yield during first lactation (Castells et al. 2012)

  B. During first 6 months

  → lower age at first calving (Brickell et al. 2009) CONFIRMED

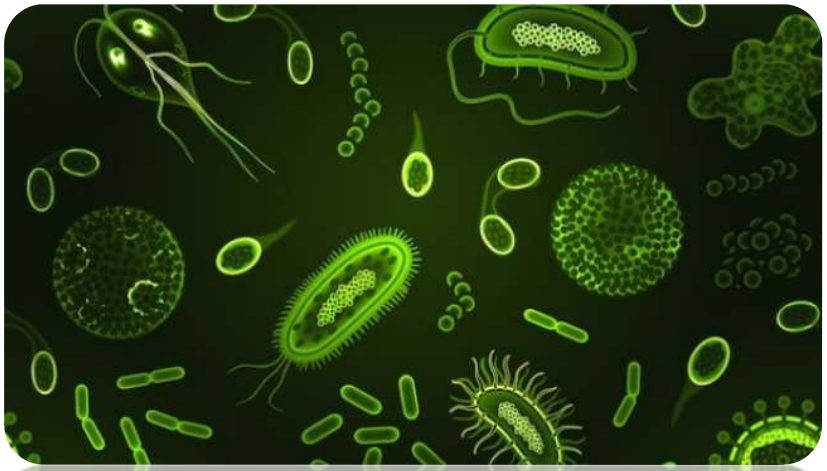
Further measurements: around calving (±3 weeks)

- Individual measurements
  - Feed intake: daily
  - Body weight: daily
  - Methane emissions: daily (in Greenfeed)
  - Milk yield and composition: daily from calving

- Parameters
  - CH_4/kg DMI, CH_4/kg BW, CH_4/kg milk yield, CH_4/kg FPCM
  - Feed conversion efficiency: kg milk/kg DMI

Ongoing analyses

- Microbial analysis of rumen fluid samples
  - Abundance and diversity of important groups of Bacteria, Protozoa and Archaea; activity of the methanogenic population
  - *No differences in CH_4 emissions, but perhaps in microbial communities?*
  - *Explanation for better growth of LIN and ESS calves?*



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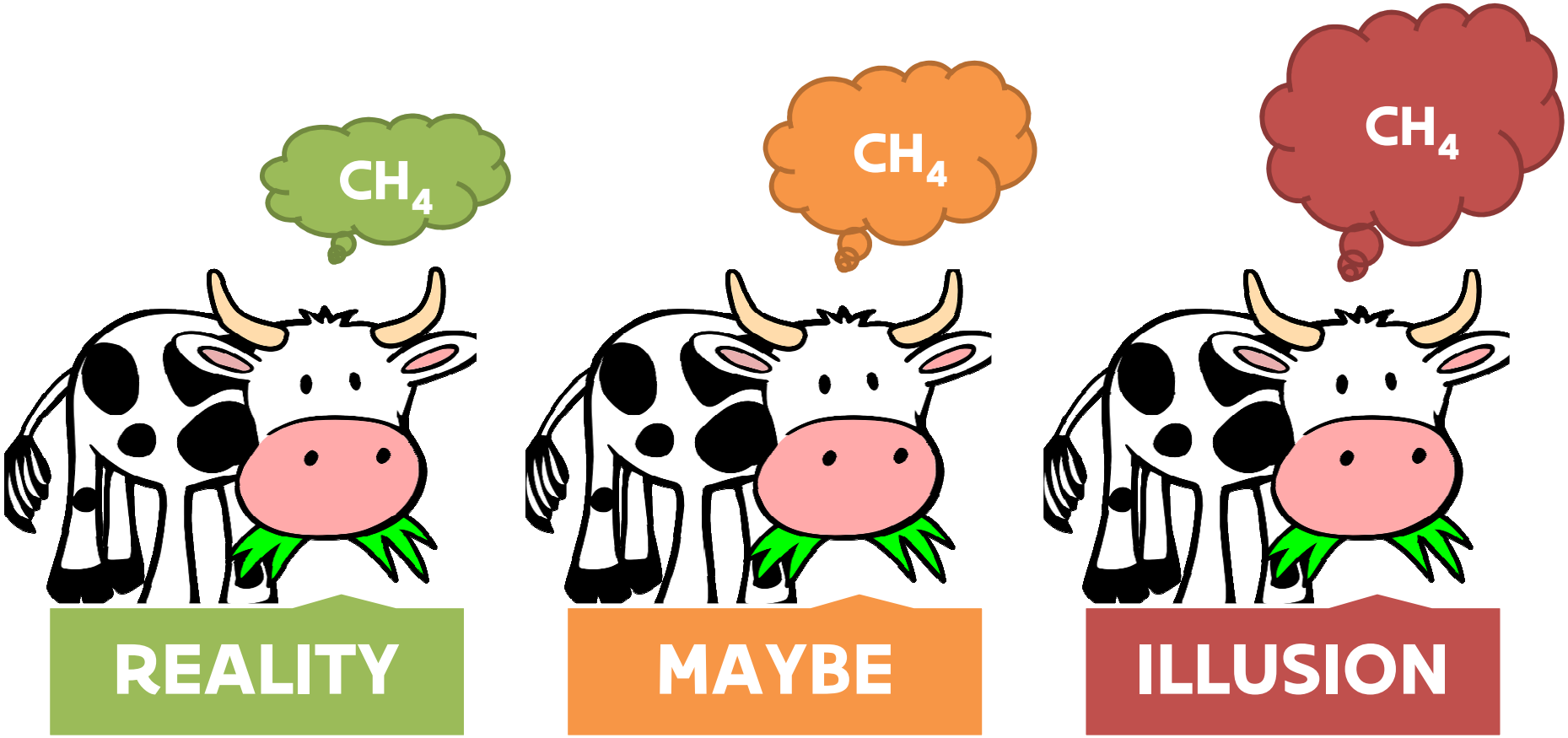
Reality or illusion?



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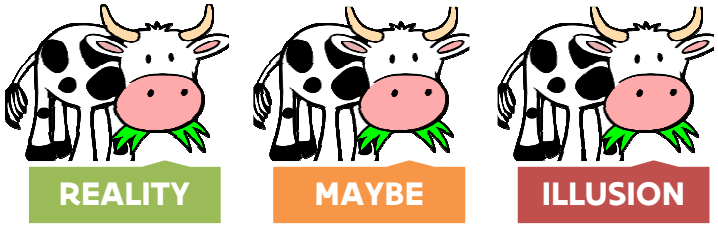

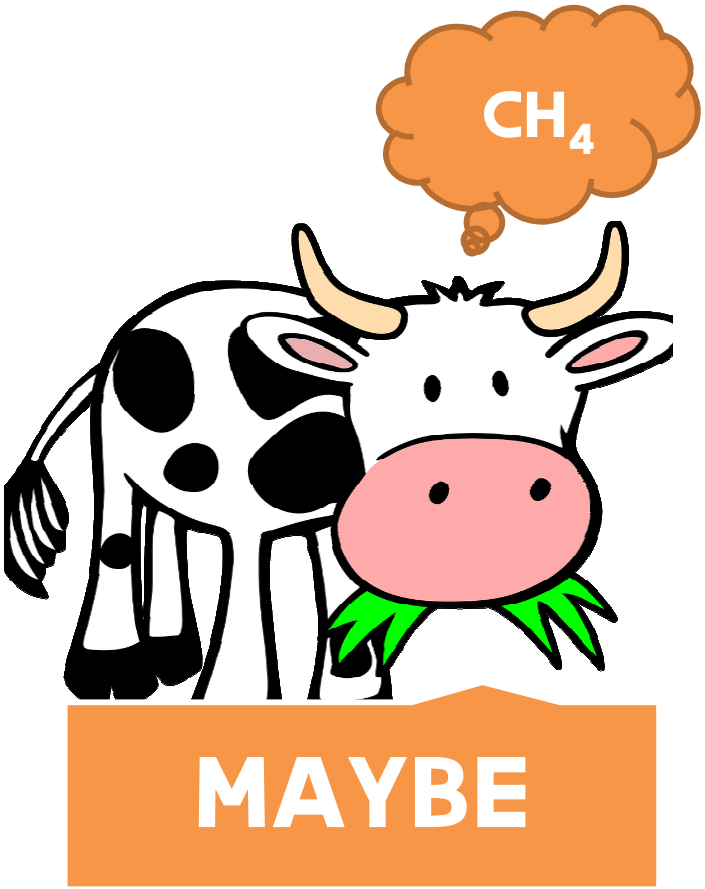

Methane reduction in this study could be possible through:

- Lower age at first calving
  (-1 month: -7% CH_4 emissions)

- Higher milk yield during first lactation
  (lower gCH_4/kg milk yield, pending)

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Dank u wel

Thank you

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