

Effect of 100 g lemongrass as feed supplement on methane concentration in the respiratory air of beef cattle



A public private partnership project of



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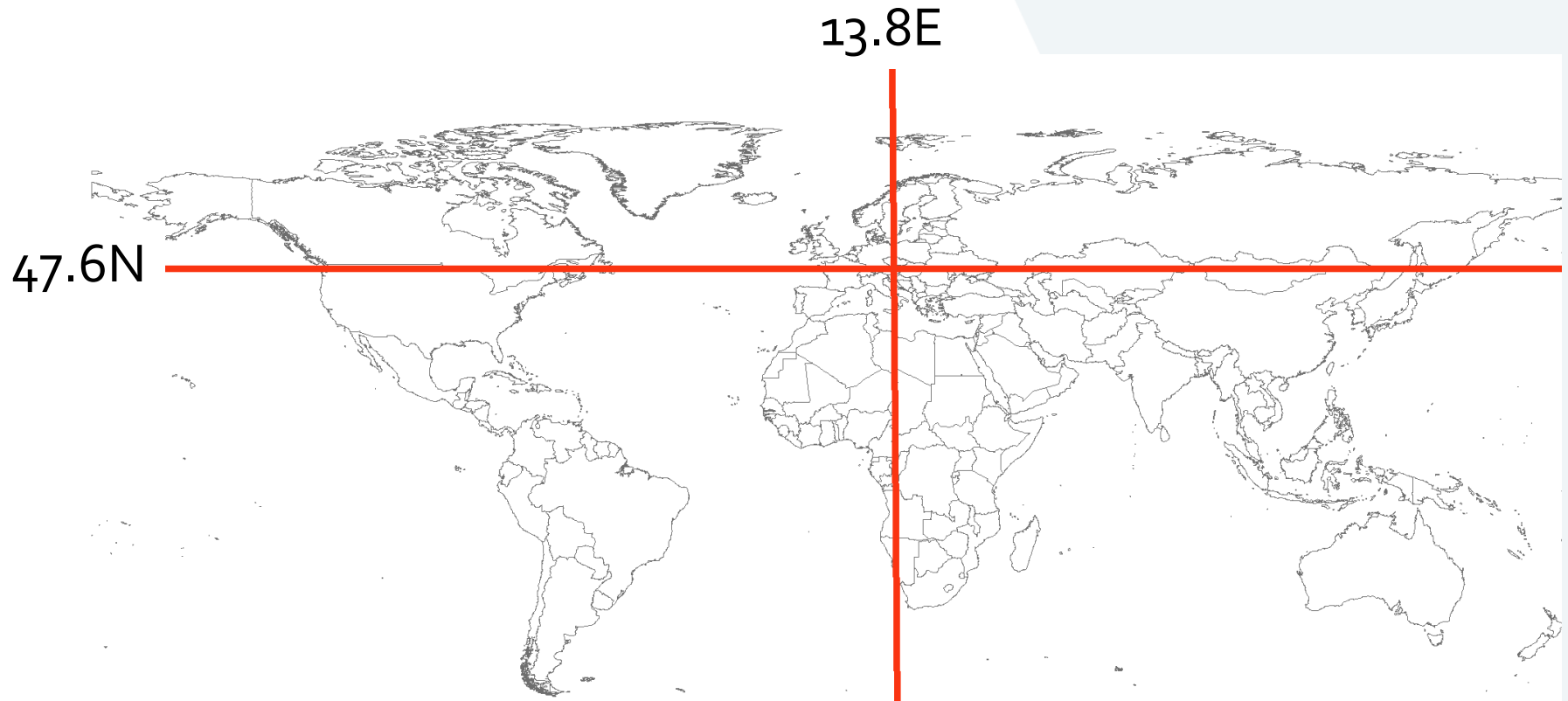


Dr. Stefan
Rosenkranz

Who we are!

- **Largest Teaching and Research Unit for Agriculture in Austria**
- **Part of Ministry of Agriculture, Regions and Tourism**
- **330 qualified employees**
- **450 pupils** in the education sectors **Agrarian Marketing, Agrarian Management; Environmental und Resources Management**
- **About 100 actual research projects**
- **Locations for research all over Austria**

Where we are!



Where we are!



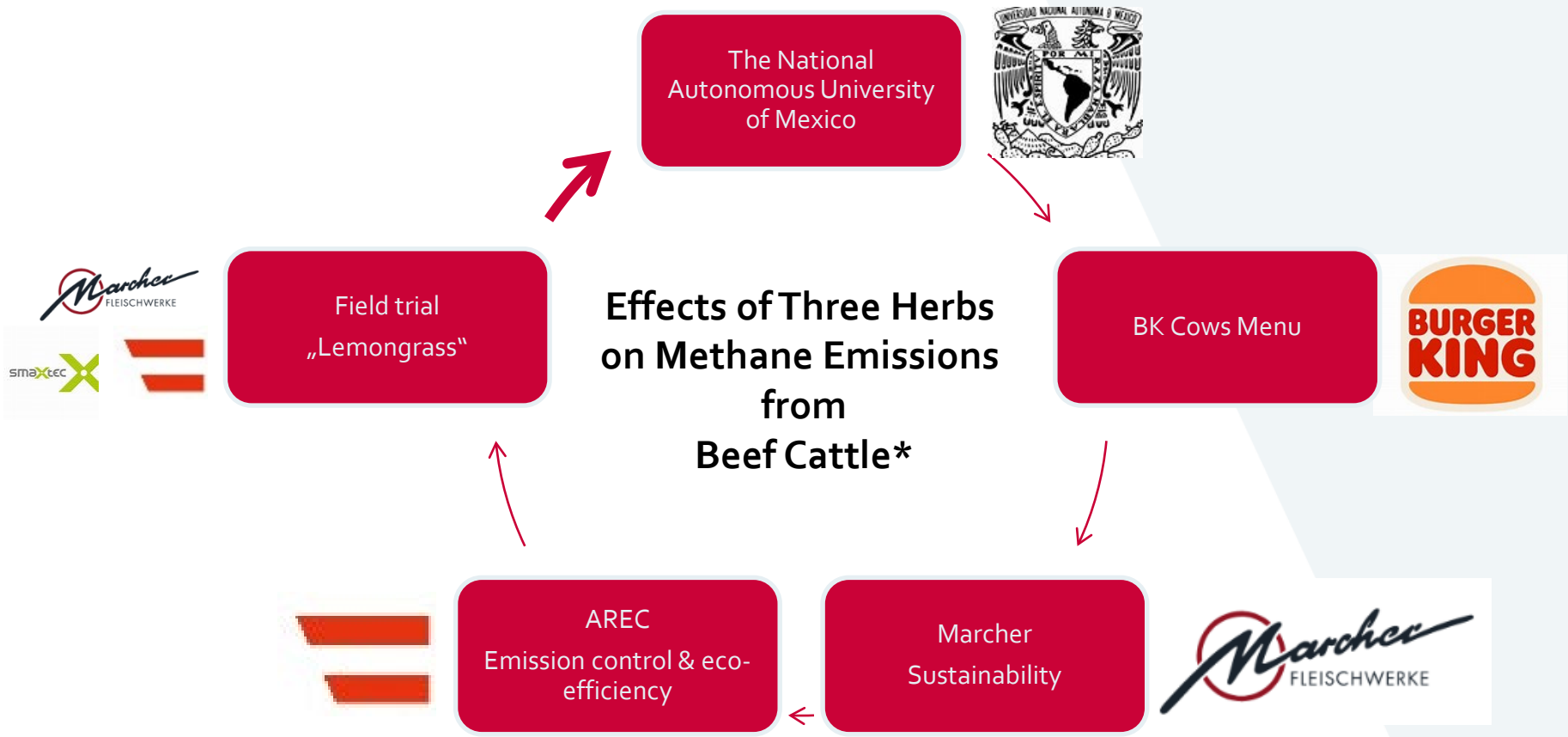
1,34 Mio. ha Cropland
2,8 Mio. Pigs

1,26 Mio. ha Grasland
1,9 Mio. Cattle
0,5 Mio Sheep & Goat

Where we are!



Relationship chain

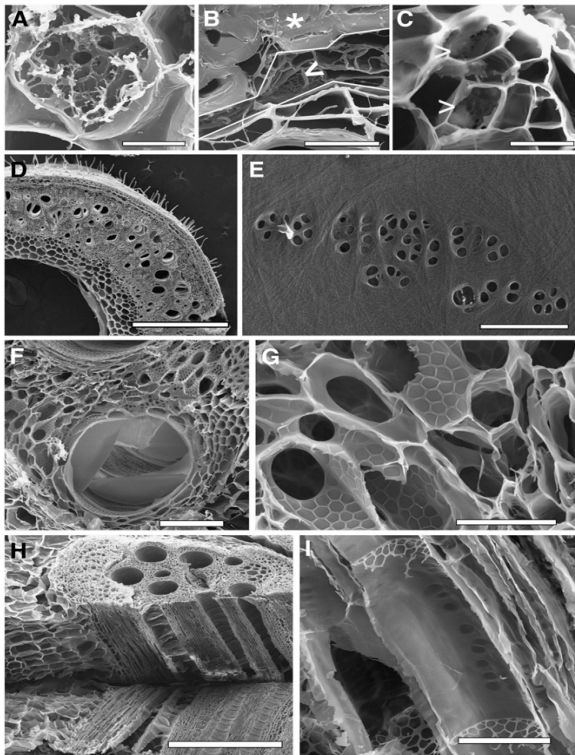


* Vázquez-Carrillo et al. 2020, Animals, 2020, 10, 1671

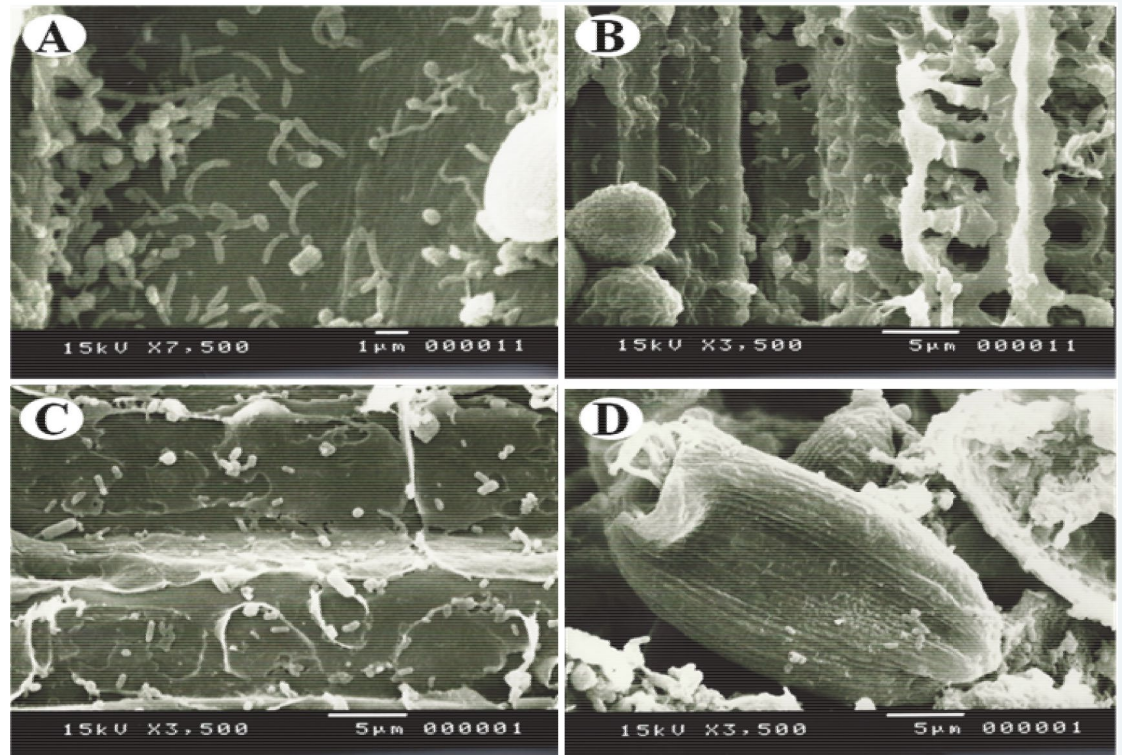
The enteric fermentation...

Plants...

... will be disassembled in rumen

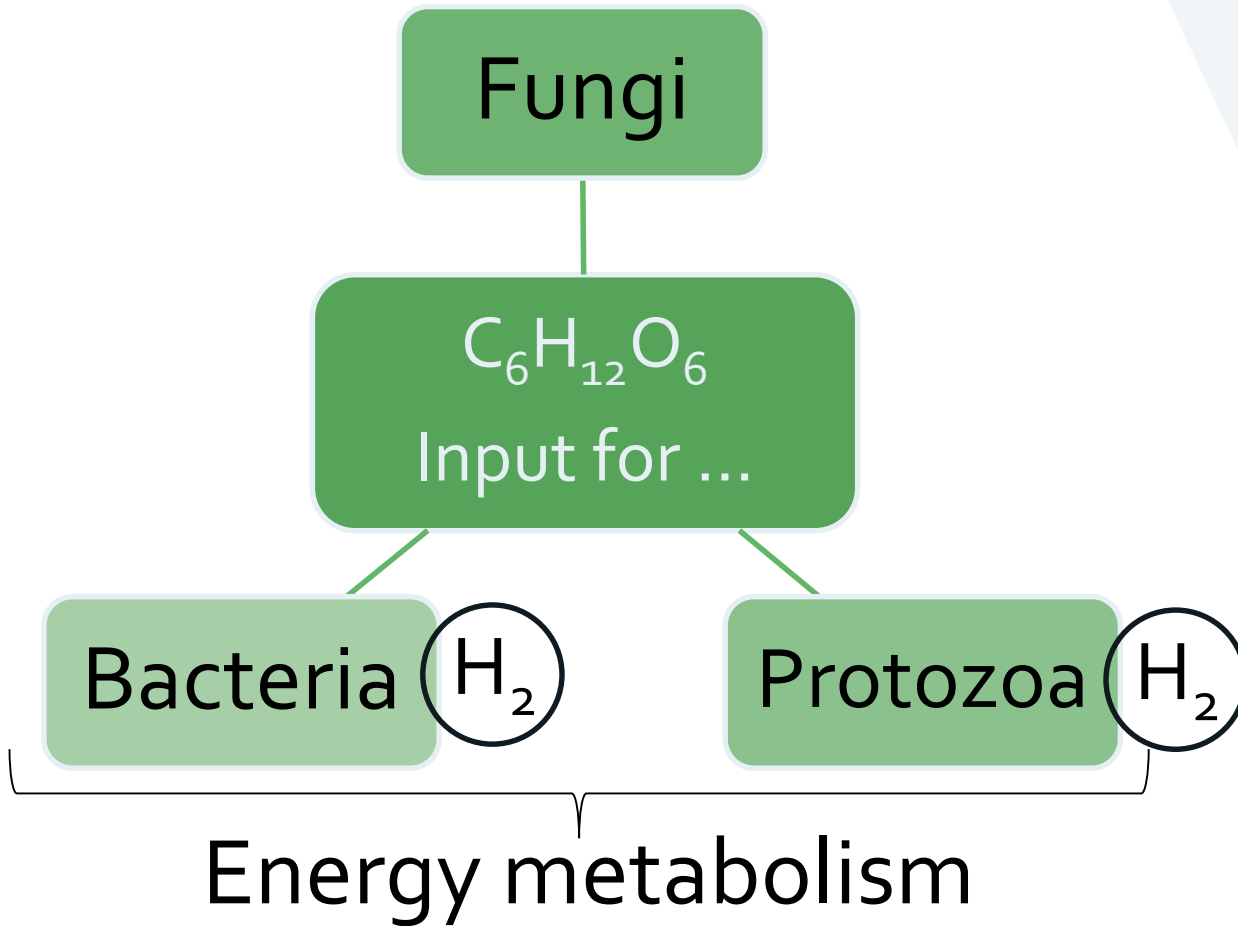


MULLENDORE, D., C. WINDT, H. AS und M. KNOBLAUCH, 2010:
Sieve Tube Geometry in Relation to Phloem Flow.
The Plant cell 22, 579-593.

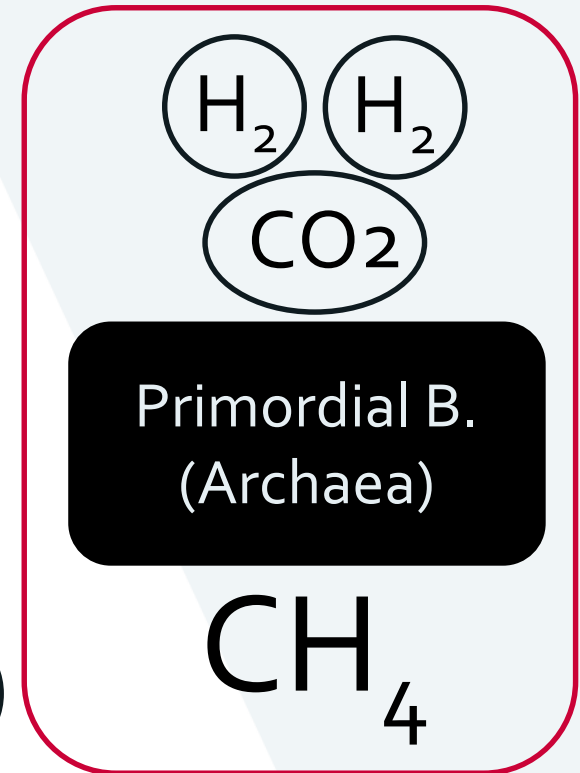


JESUS, R.B.D., W.P. OMORI, E.G.D.M. LEMOS und J.A.M.D. SOUZA, 2015: Bacterial diversity
in bovine rumen by metagenomic 16S rDNA sequencing and scanning electron microscopy.
Acta Scientiarum. Animal Sciences 37, 251-257.

CH₄ is produced from ...



Garbage collector



CH₄ can be decreased ...

indirect

Feeding/Fodder

- (Hemi)Cellulose
- (+) Starch
- (+) Oil
- (+) Saponins, **Tannins**
- (+) Feed acids
- (+) Salts

(+) is in contrast to
to natural feeding

Host (cattle)

- Selection for low
CH₄ emissions
- [Reduction of the total
flux through performance
increase and/or
shrinkage]

[] is in conflict with
with the cultural landscape

direct

Rumen flora

- Hydrogen flux
- Vaccination of
cultures

Nach BRADE, W. und O. DISTL, 2015: Das
ruminale Mikrobiom des Rindes - Teil 2:
Archaeen – Substratspezialisten im
Pansenmikrobiom.
Berichte über Landwirtschaft-Zeitschrift für
Agrarpolitik und Landwirtschaft 93.

Condensed Tannins → Lemongrass

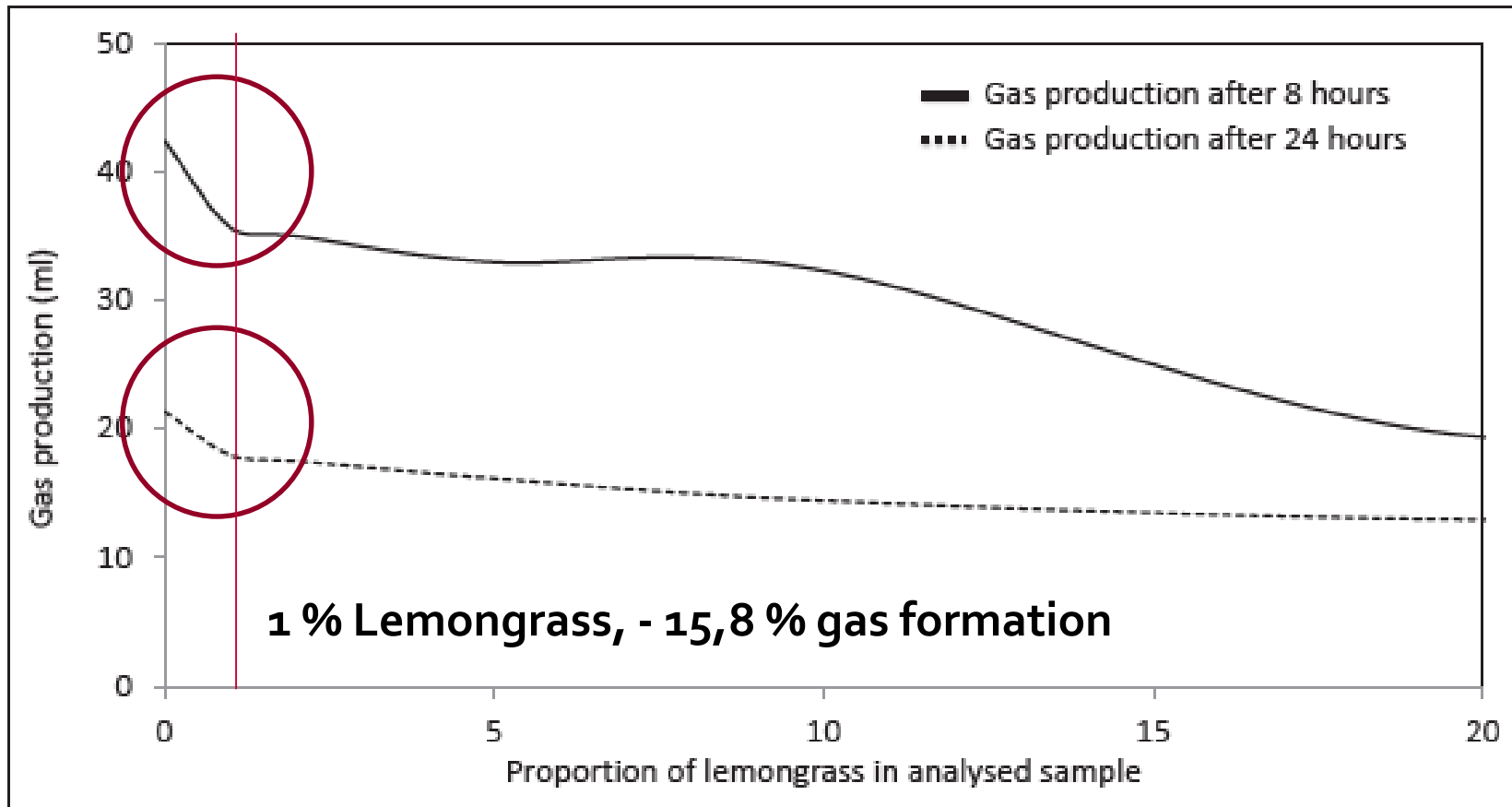
Feed	Weender nutrients and fiber components											Energy		Condensed Tannins
	FM	XP	XL	XF	XA	XX	OM	NDF	ADF	ADL	NFC	ME	NEL	
	g/kg DM											MJ/kg DM		g/kg DM
Lemongrass	912	75	30	328	75	492	925	654	347	52	166	8.59	4.96	>60



First step: laboratory test with gas-emission-potential



Effect in laboratory tests



Second step: Methane measurements in the field trial



Family farm Schrammel in Austria lowland



Field trial

Feeding 1.2 to 1.7 % lemongrass (1 ‰ Tannin)



BK Cows Menu
recommendation
100 g/animal and day

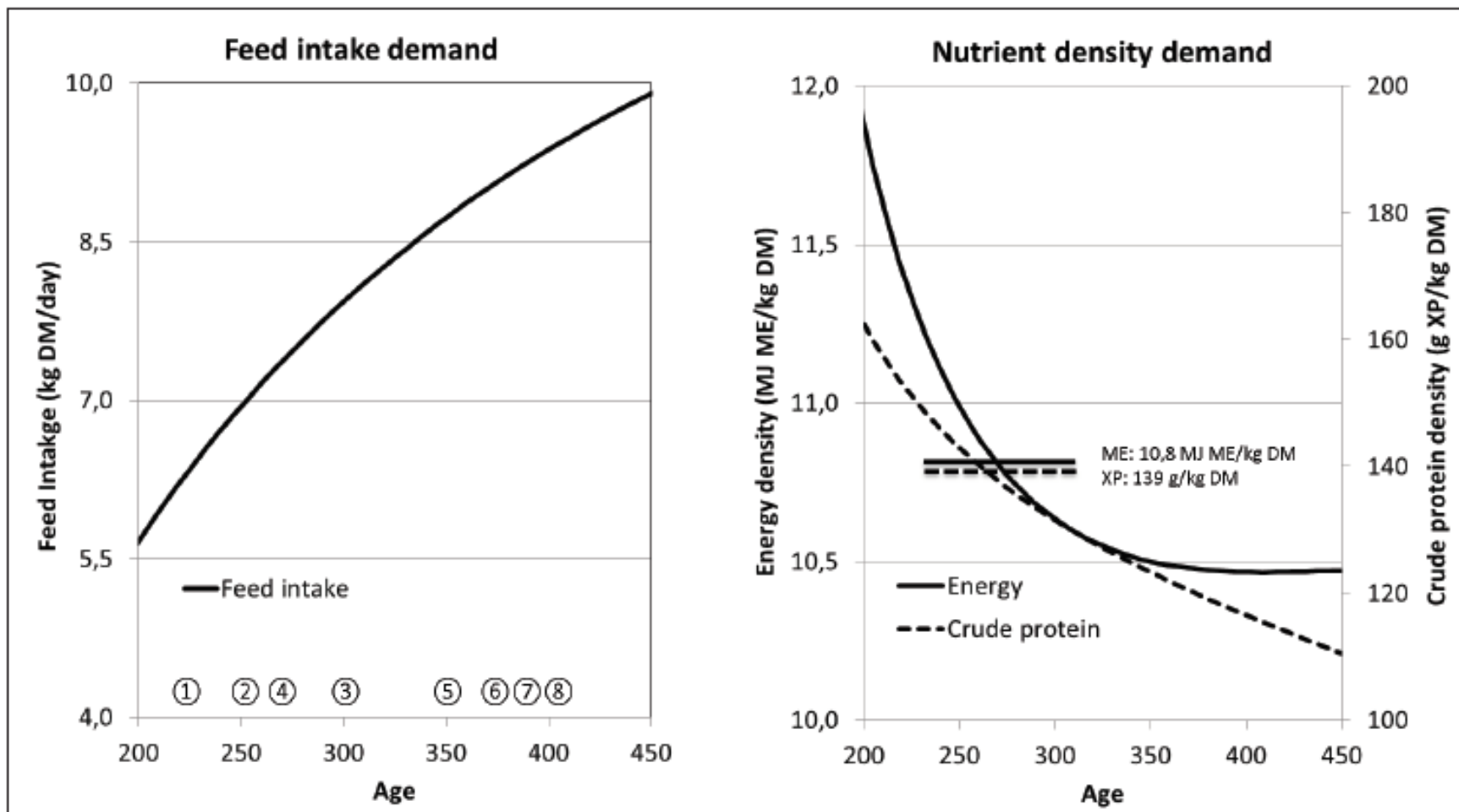


6 % condensed tannins in lemongrass

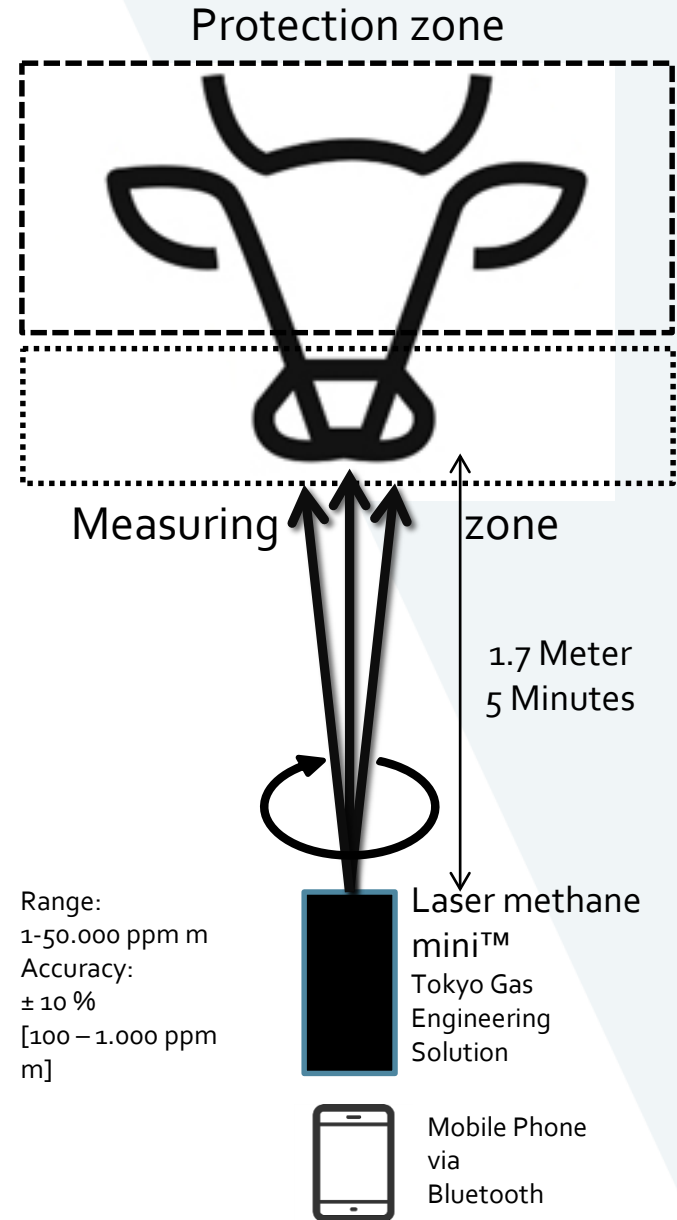
Trial setup

	Feeding 100 g of lemongrass per animal per day			
	1. Repetition		2. Repetition	
	Measurement period			
	1	2	3	4
Box	21.09-09.10	10.10-30.10	31.10-20.11	21.11-11.12
①	with	without	with	without
②	without	with	without	with
③	with	without	with	without
④	without	with	without	with
⑤	with	without	with	without
⑥	without	with	without	with
⑦	with	without	with	without
⑧	without	with	without	with
Order	① → ⑧	① → ⑧	⑧ → ①	⑧ → ①

Feed intake and nutrients

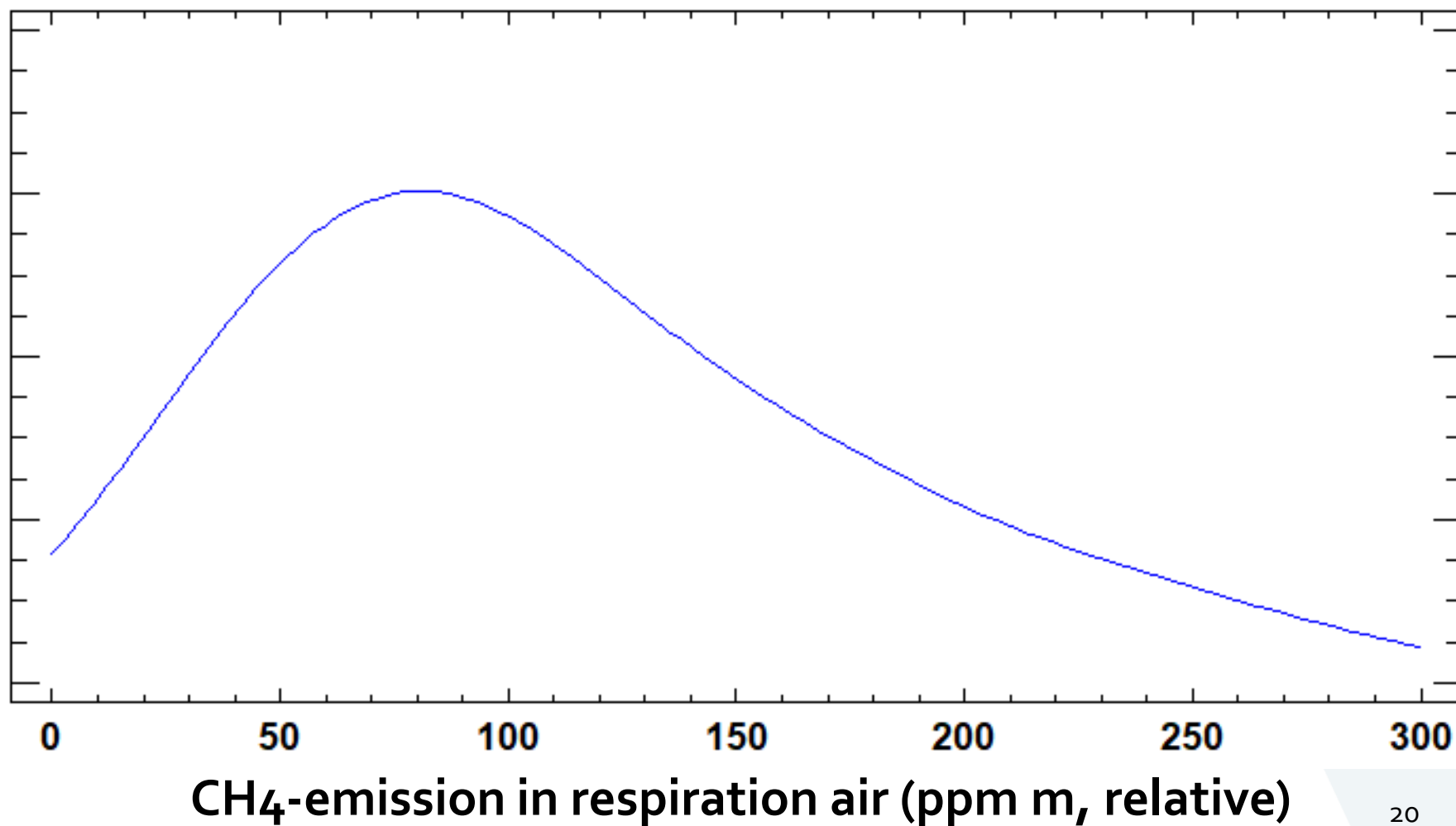


CH₄-Measurement



CH₄-Wiederkäuer AT

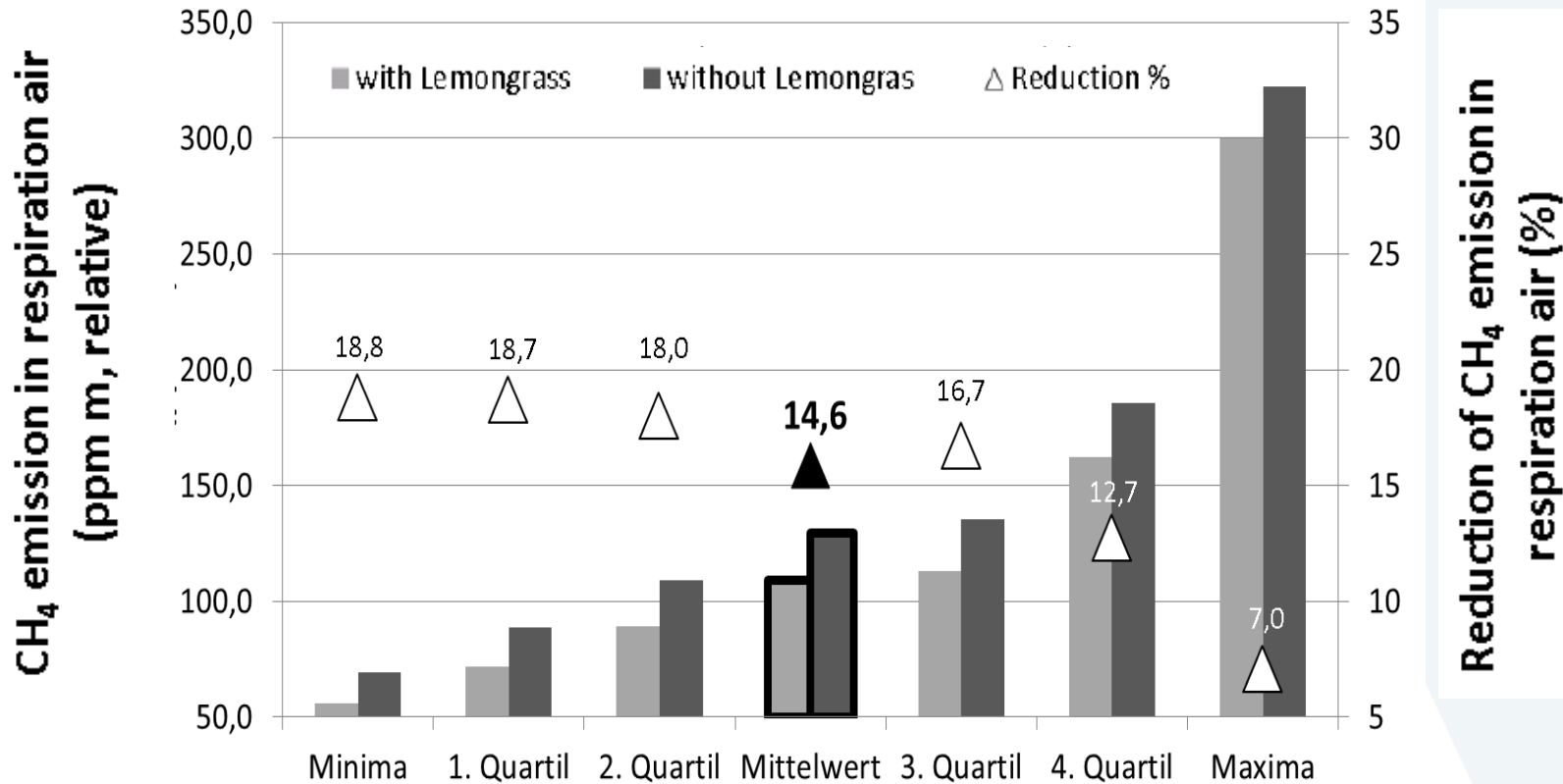
Distribution in the measurement signal (~ 99.000 Points)



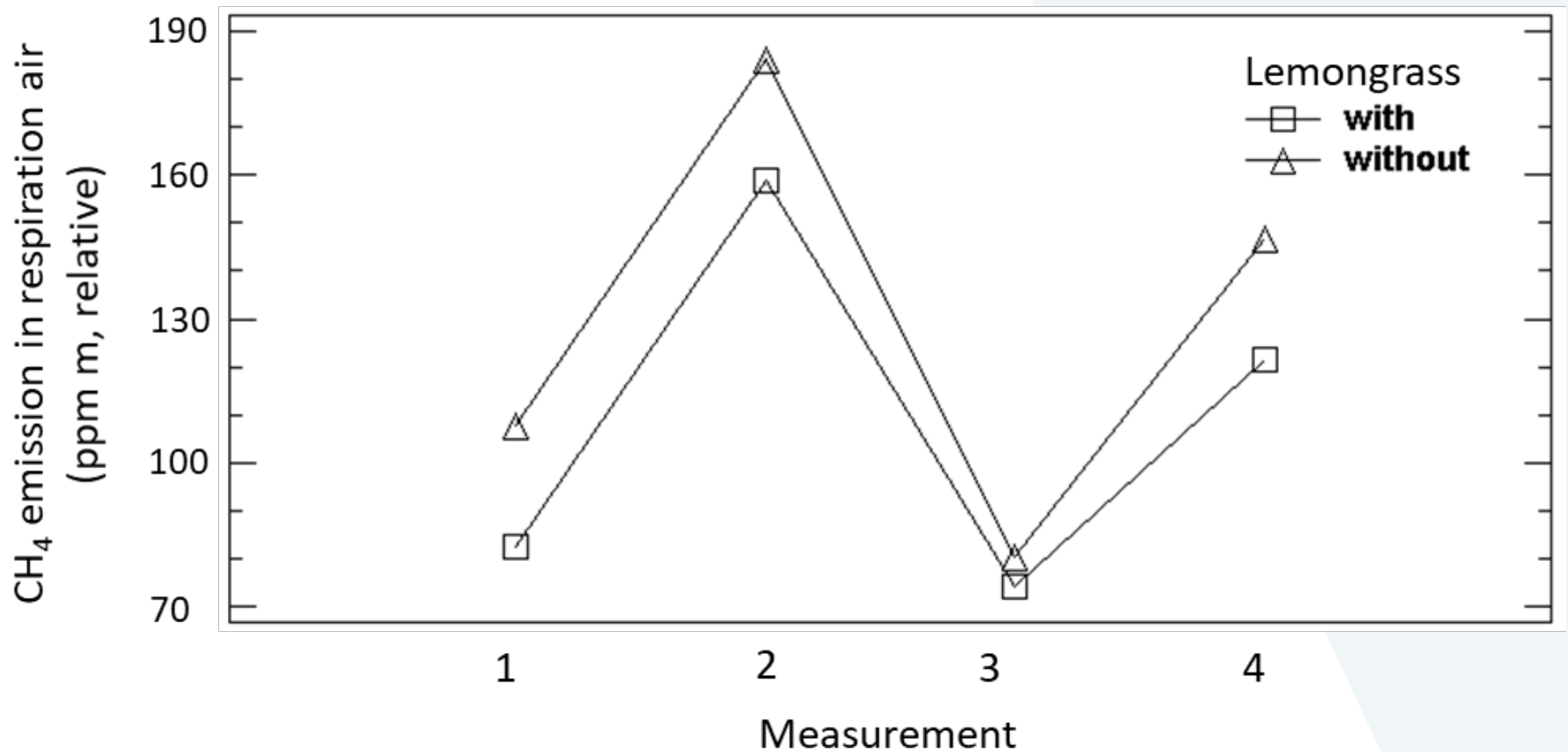
Statistical analysis of CH₄-concentration in breath

Parameter		Lemongrass (Z _i)		Measuring period (MP _j)				MAE	p-value			R ²
		with	without	1	2	3	4		Z _i	MP _j	Z _i x MP _j	
Methane concentration in the breath (CH ₄)												
Minima	ppm m	56.2	69.1	42.3	92.0	36.6	79.6	21.9	0.005	0.000	0.503	43.7
1. Quartile	ppm m	72.0	88.6	58.1	116.5	49.7	96.9	25.6	0.003	0.000	0.511	43.3
2. Quartile	ppm m	89.4	109.0	76.1	143.9	62.8	114.1	29.1	0.002	0.000	0.575	43.7
3. Quartile	ppm m	113.0	135.6	99.5	180.1	80.1	137.5	33,3	0.003	0.000	0.678	44.3
4. Quartile	ppm m	162.2	185.8	146.6	245.8	115.5	188.0	42.1	0.013	0.000	0.831	43.7
Maxima	ppm m	299.8	322.5	276.5	400.3	223.4	344.6	6.9	0.116	0.000	0.653	37.0
Mean	ppm m	109.1	129.7	95.1	171.6	77.0	134.1	32.0	0.004	0.000	0.691	44.2

Methane measurements in the field trial (Ø -14,6 %)

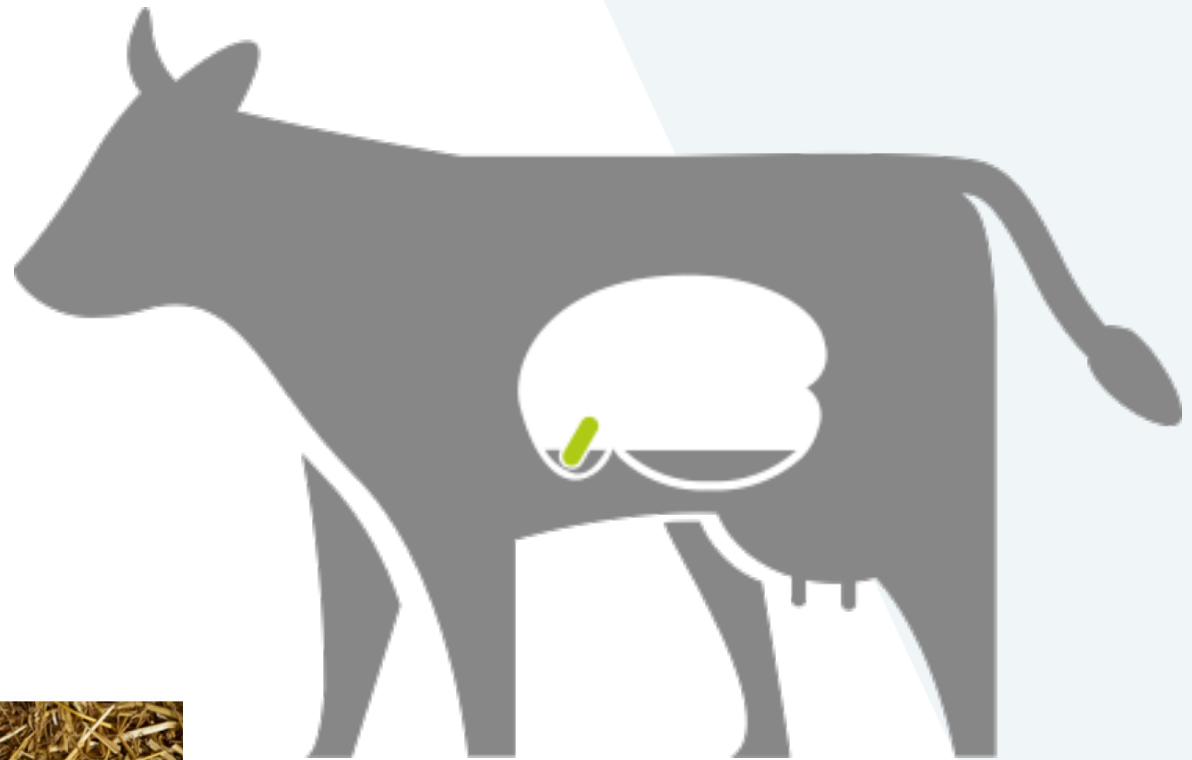


Methane measurements in the field trial (-7,8 bis -23,4%)

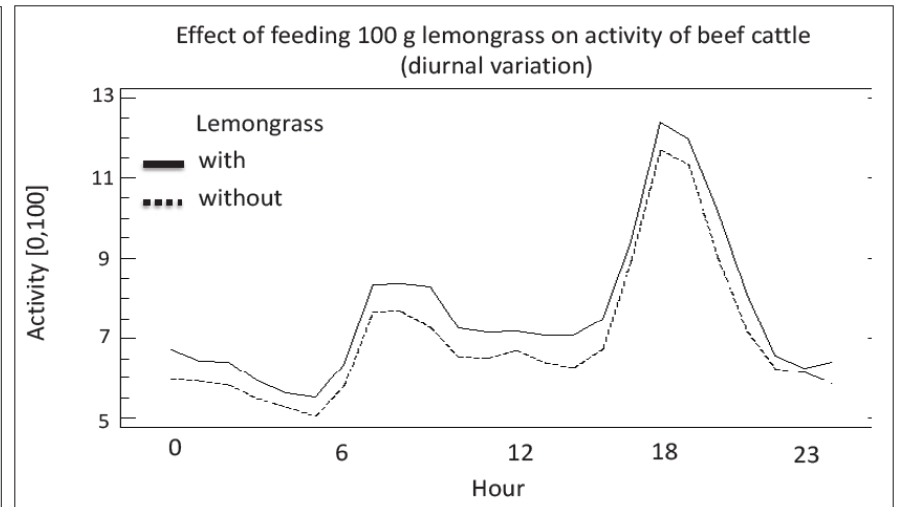
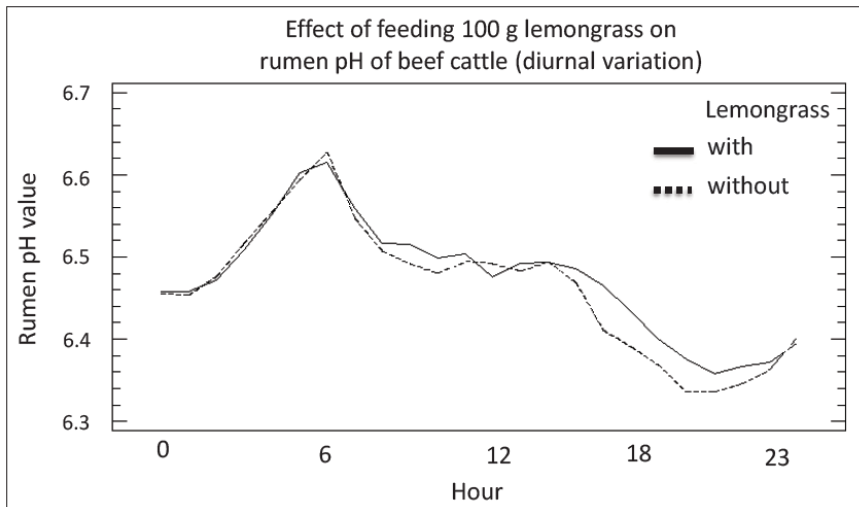


The smaXtec-Sensor

- pH-Value
- Temperature °C
- Drinking activity n
- Ruman activity [0,100]



Impact of Lemongrass on rumen pH and activity



Statistical analysis of rumen parameter (smaXtec)

Parameter	Lemongrass (Z _j)		Measuring period (MP _j)				Hour (S _k)	MAE	p-value				R ²	
	with	without	1	2	3	4			Z _j	MP _j	S _k	Z _{jj} x S _k		
Analyses in the Rumen (smaXtec-Sensor)														
pH		6.47	6.46	-	6.45	6.47	6.49	Figure 15	0.028	0.124	0.000	0.000	1.000	86.4
Temperature	°C	38.93	38.91	-	38.90	38.96	38.90	Figure 16	0.047	0.247	0.000	0.000	0.006	80.1
Drink	n	10.8	9.9	-	-	-	-	Figure 18	2.39	0.225	-	0.000	0.760	74.9
Aktivität	[0,100]	7.7	7.1	-	7.7	8.0	7.5	Figure 17	0.76	0.002	0.009	0.000	1.000	78.7

Feeding lemongrass → the effects

- VÁZQUEZ-CARILLO et al. 2020: Reduction in CH₄ load between 16,4 and 26.0%.
- GUGGENBERGER et al. 2021:
 - Field trial:
 - 47 fattening bulls (300-600 kg)
 - 4 Periods / 2 Repetition (with / without 100 g Lemongras per head/day)
 - Reduction in CH₄ load between 7,8 and 23,4% (Ø 14,6 %)
 - Rumen sensor: No significant impact in rumen parameter
 - Laboratory test: Reduction of 15,8% in gas formation.
- The results of both studies matches each other!

Next step

- Organise the lemongrass chain
- Testing Esparsette (*Onobrychis viciifolia*) which grows in Austria
- Investment in a microbial laboratory
- Discussing the CH₄ problem from a broader perspective



It is only our contribution that we become part of
the solution!