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CLIMATE CHANGE IN AGRICULTURE

Project Nr. 586273-EPP-1-2017-1-EL-EPPKA2-CBHE-JP

Options for evaluating GHG and ammonia emissions in dairy husbandry

CLICHA Business forum

Land management and agricultural practices for reducing greenhouse gas and ammonia emissions

Jelgava, 27.02.2020

Dr.agr. Diana Ruska, senior scientist

Institute of Animal Sciences

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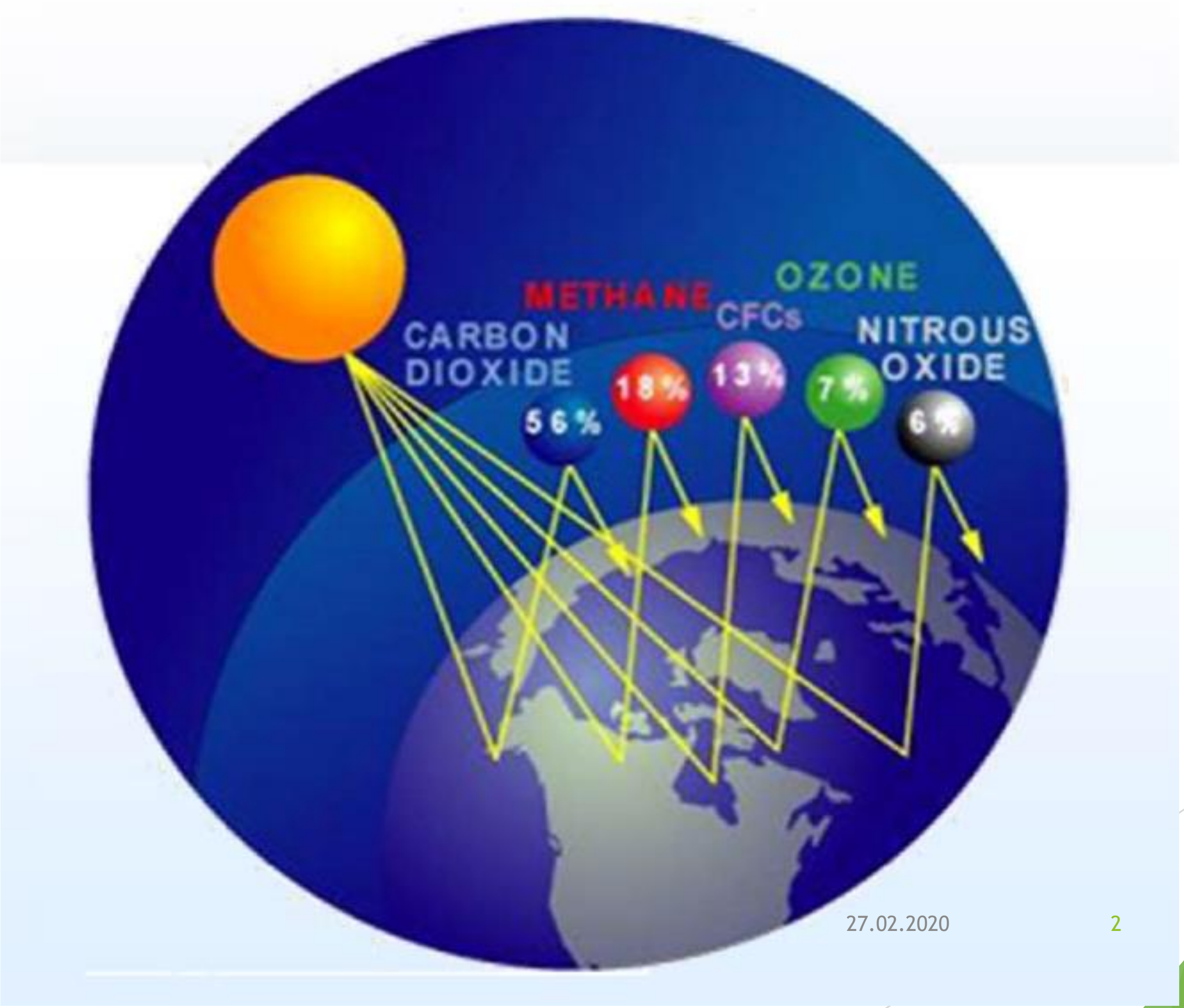
Earth need SEG emission



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Ruminants – dairy cows

- Rumen is a place with various of biosystems where together leave different kinds of microorganisms.

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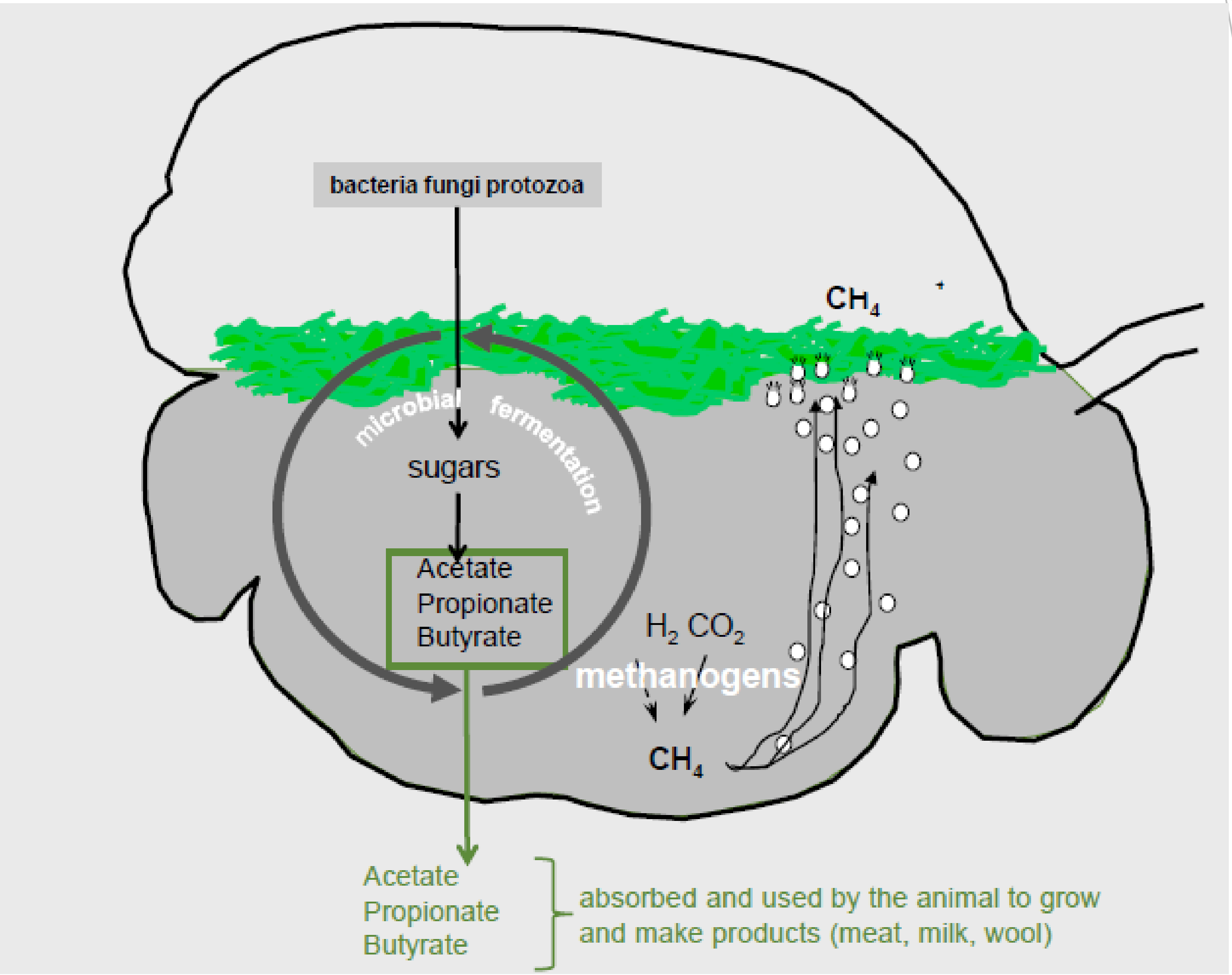
Rumen world



Attwood et al., 2019

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Facts about CH_4

- a **dairy cow** produces 200 to 650 g methane per day
- not the cow, but the micro-organisms in the rumen produce methane from CO_2 and H_2, both formed during anaerobic fermentation of the feed
- Life cycle of methane are 10-12 years

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Factors affecting the rumen microorganisms

- ❑ Feed ration changes
- ❑ Age of animal
- ❑ Animal health
- ❑ Use of antibiotics
- ❑ Geographical location
- ❑ Season
- ❑ Photoperiod

- Environmental conditions
- Stress
- Feeding scheme
- Genetics
- Species, breed (different ruminants in one pasture, different composition of bacteria)

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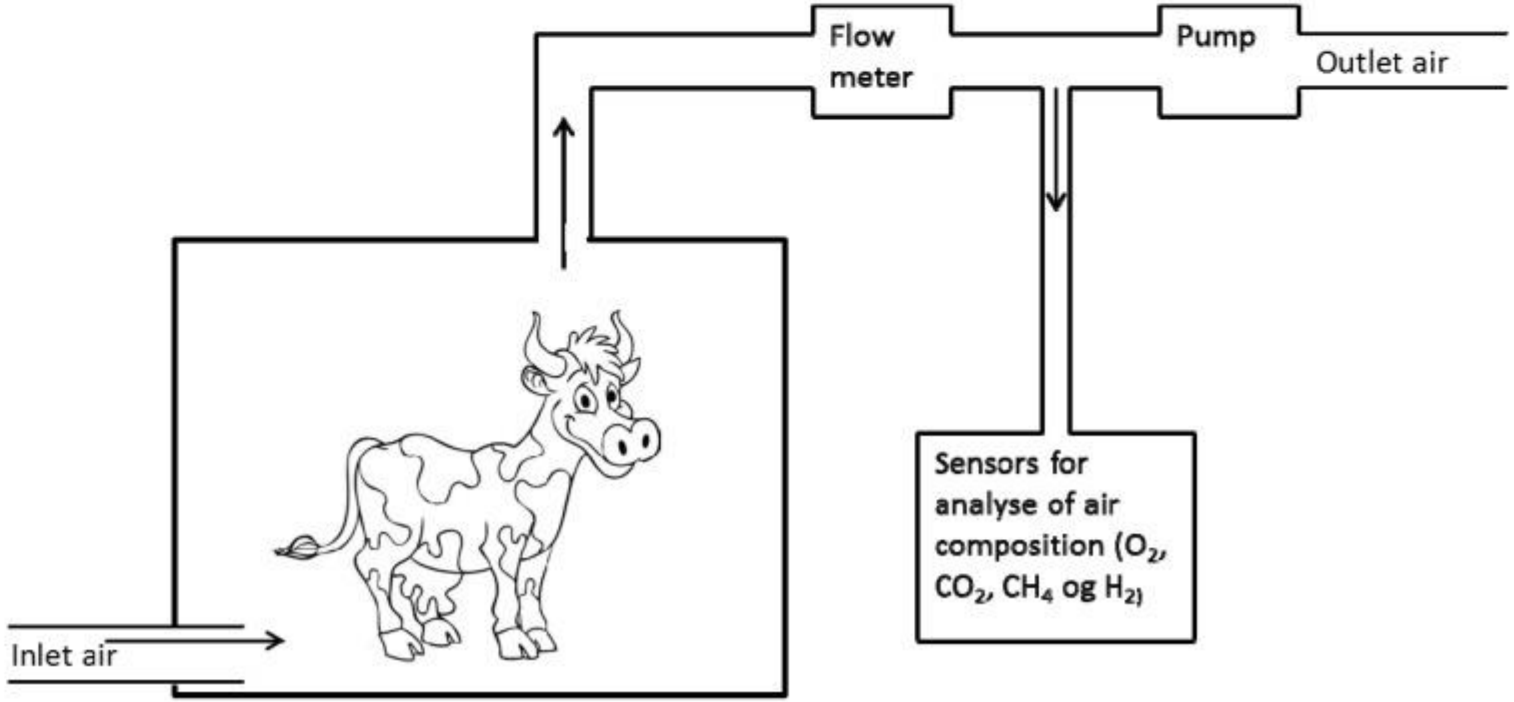
GHG emission measurements in study



Storm et al, (2012)

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Improve fermentation in the rumen

- Feed additives
- Formulation and estimation of feed ration
- Management of feeding strategies, reduced methane and carbon emissions in milk production

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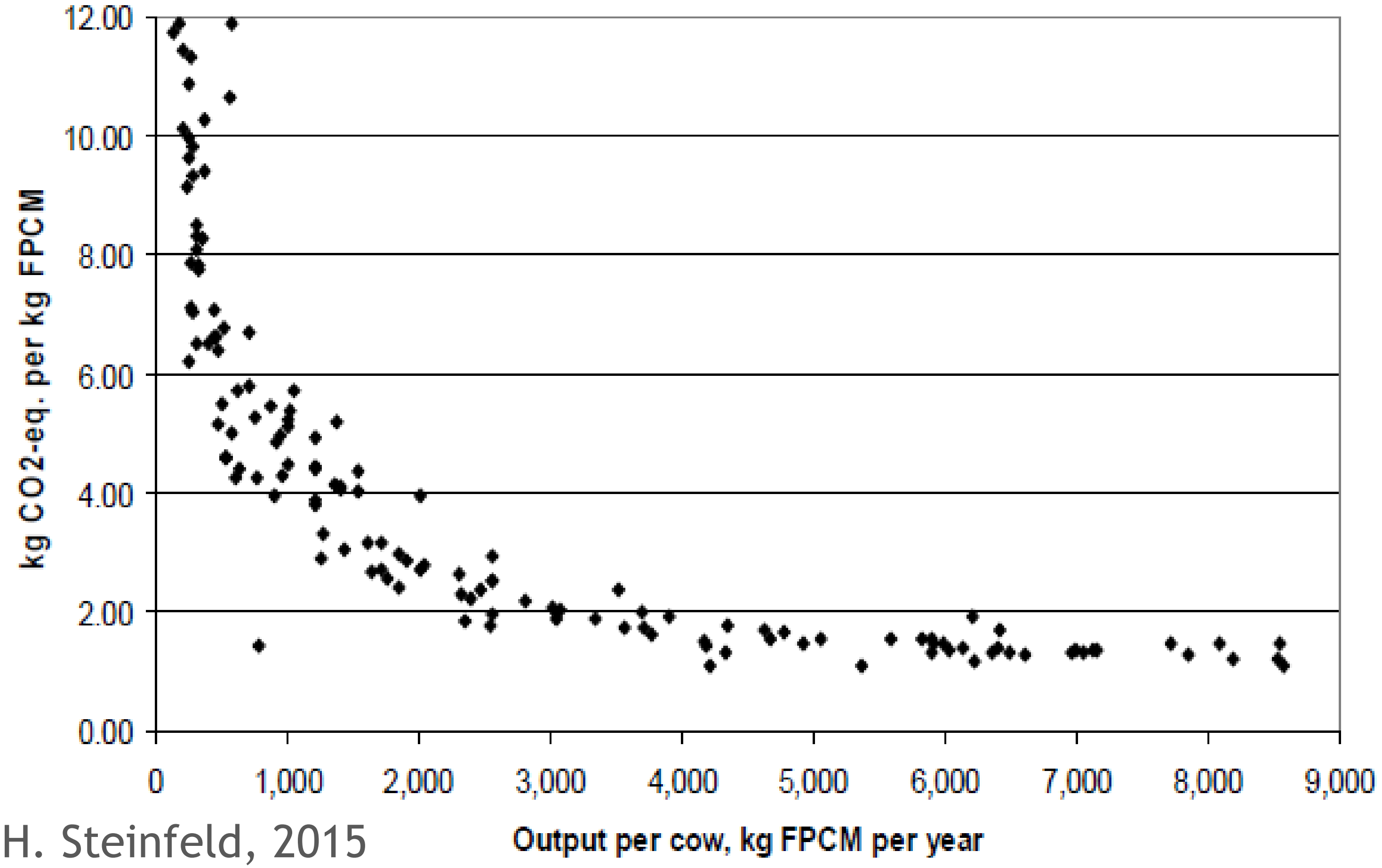
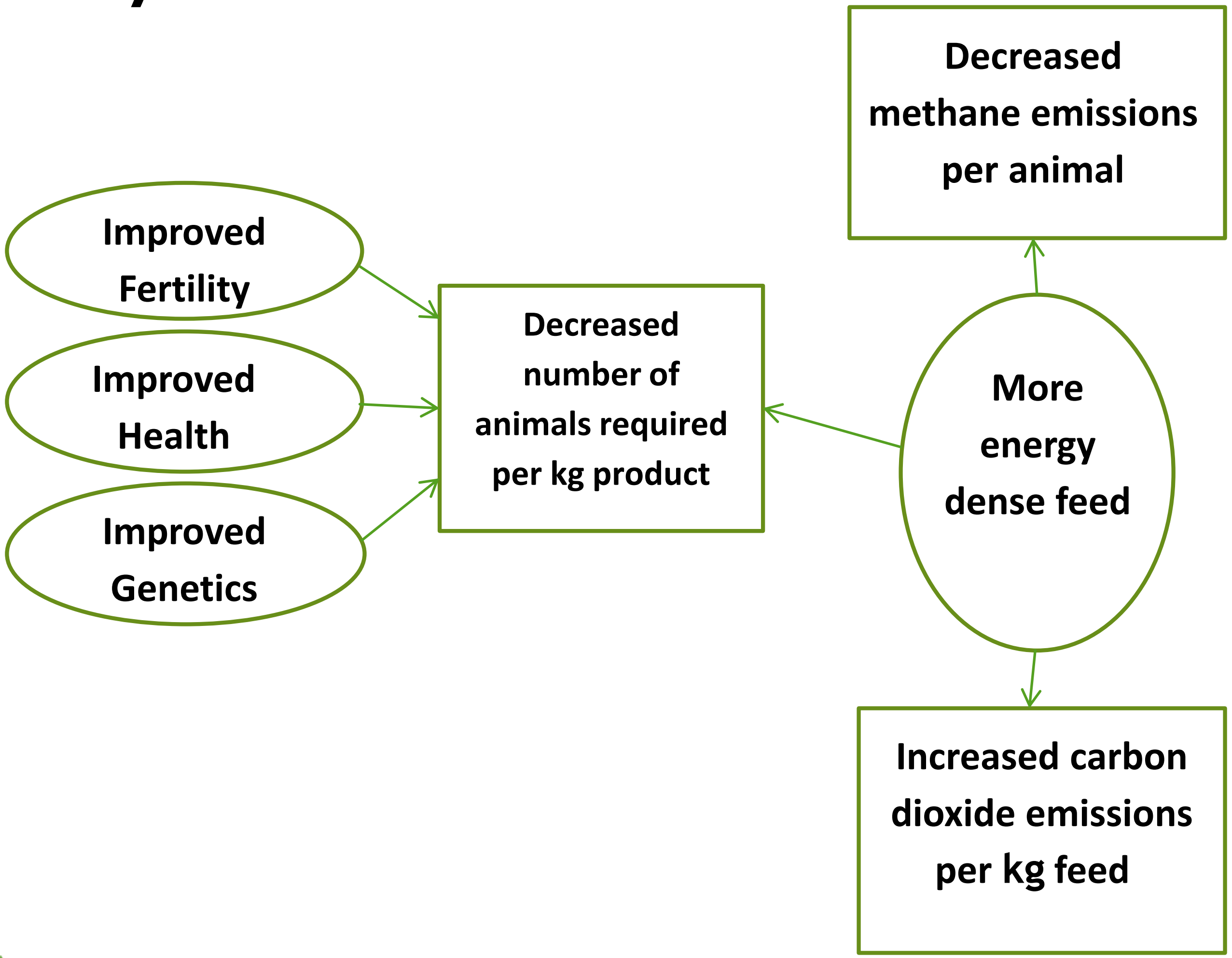
Relationship between total greenhouse gas emissions and milk output per cow



H. Steinfeld, 2015

Mitigation: interventions to improve productivity



Nitrous oxide emissions depend on number of animals, feed, manure management, soil and weather

Carbon dioxide emissions from land use change associated with livestock depend on energy density of feed, carbon content of soil, management practices, weather

Gill et al., 2010

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Improve productivity

- High inputs of N fertilizers and protein-rich feeds contribute to allow high production levels, but most of the N ingested is not retained in milk but excreted again in urine and faeces.

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Actuality

- Urea excretion has the potential to serve as a biological tool to monitor nitrogen losses in dairy cows.
- The variation in milk urea concentrations among herds and cows indicates a wide variation in protein, energy and water intake within dairy cows and herds.

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Milk urea

- Urea is a small organic molecule composed of carbon, nitrogen, oxygen, and hydrogen.
- Urea is a normal constituent of milk and comprises part of the nonprotein nitrogen fraction.
- Urea in milk has proven to be an easily measurable indicator for protein metabolism efficiency in dairy cattle.

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Average milk yield, urea content and urea yield in control day during the research

Farms	Traits	$\bar{X} \pm S_{\bar{x}}$	Minimum	Maximum
A	Milk yield, kg	25.2±6.05[a]	9.0	36.8
	Urea content, mg dL^{-1}	20.3±6.76 [a]	2.4	37.1
	Urea yield, g	5.1±2.10 [a]	0.7	10.0
B	Milk yield, kg	23.7±6.84 [b]	5.3	53.7
	Urea content, mg dL^{-1}	27.2±8.42 [b]	5.2	56.7
	Urea yield, g	6.4±2.70 [b]	1.1	20.4
C	Milk yield, kg	17.0±5.72 [c]	6.2	28.8
	Urea content, mg dL^{-1}	46.6±15.78 [c]	17.4	79.9
	Urea yield, g	8.2±4.63 [c]	1.7	21.9
D	Milk yield, kg	27.9±9.49 [d]	3.8	61.1
	Urea content, mg dL^{-1}	26.8±5.48 [b]	12.0	44.5
	Urea yield, g	7.4±2.76 [d]	0.6	19.0

[a; b; c; d] *- traits with unequal letter, difference significantly between farms (p<0.05)*

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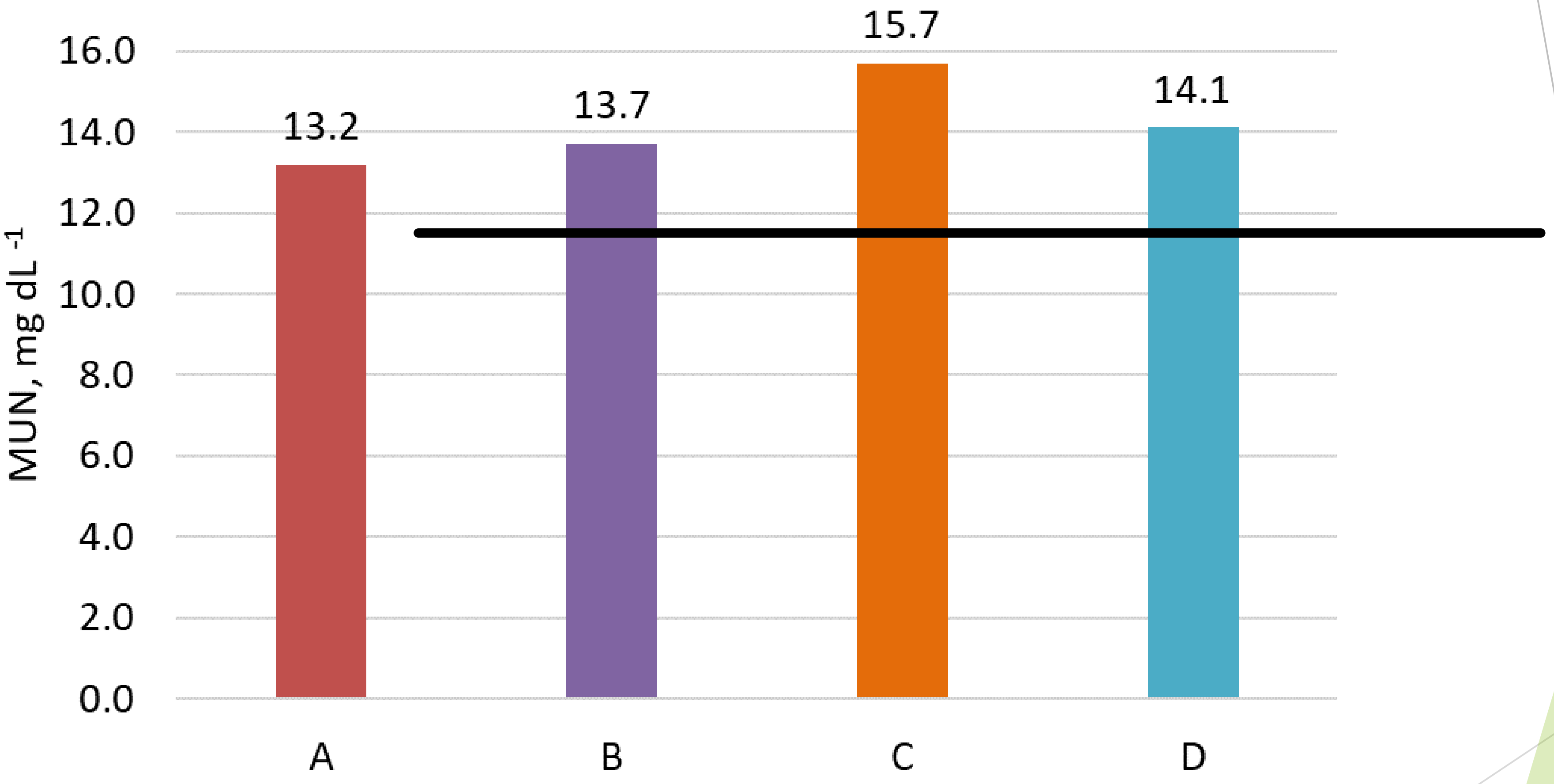
Milk urea nitrogen content in farms



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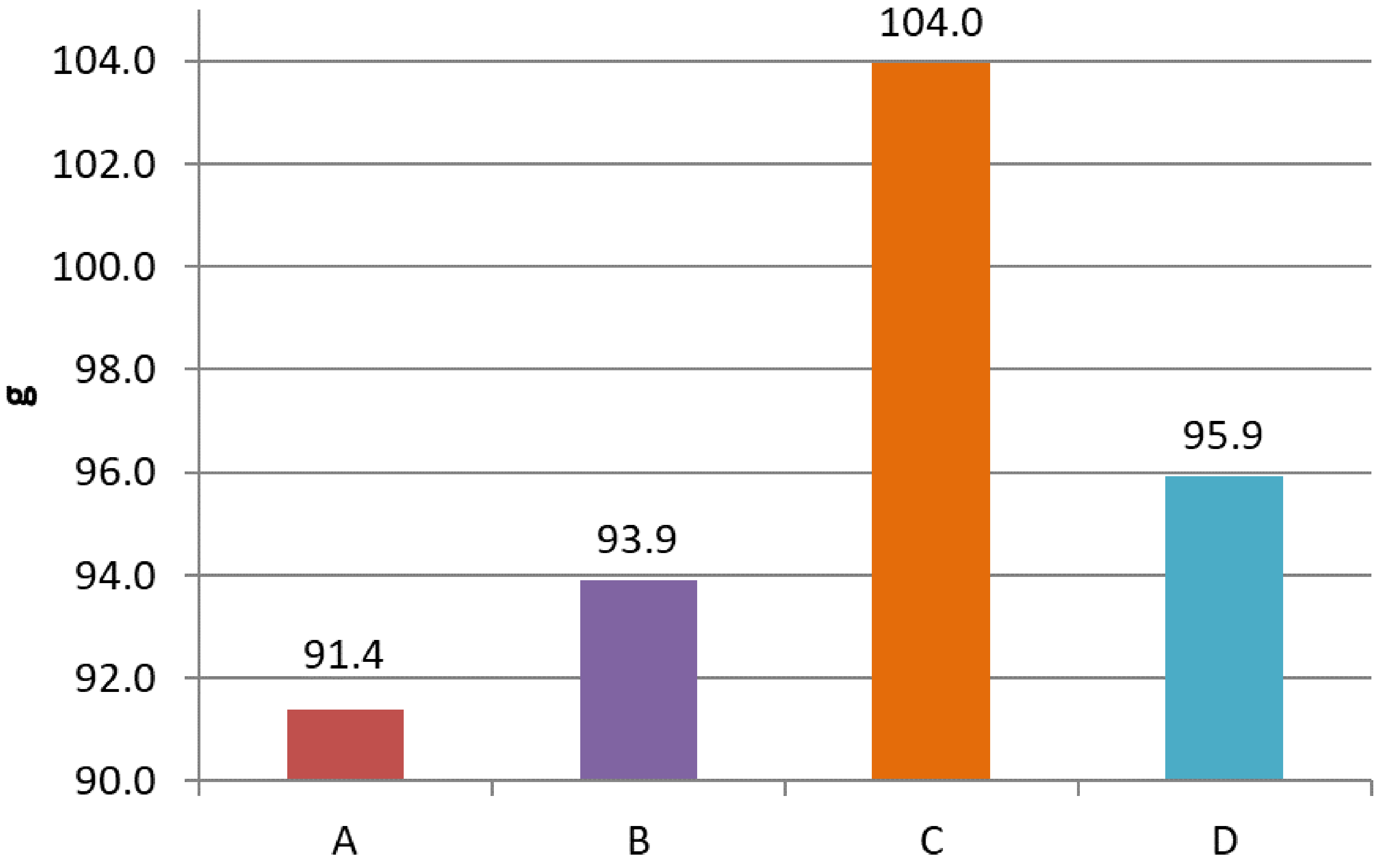
Estimated daily ammonium emission per cow in farms



Estimated by model from Burgos *et al.*, 2010

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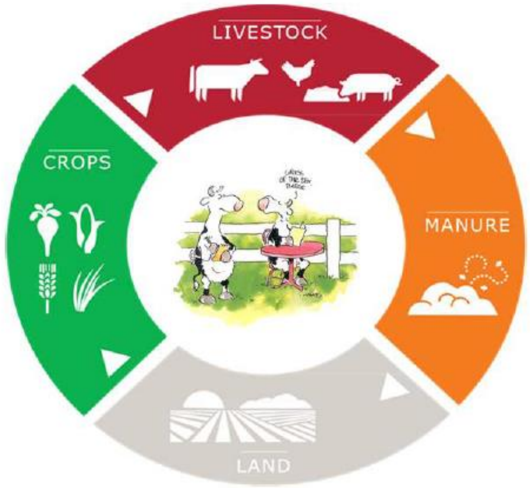
Climate Smart Cattle

50% reduction

- Genotyping low methane production for selection
- Improving feed quality and digestibility, rumen microbes
- Improving animal health and husbandry conditions
- Manure management: collection, storage and utilisation
- Improving Carbon sequestration soils
- Precision Livestock Farming

climatesmart



40% more

- More efficient use of Crops
- No specific Feed production
- Better Agricultural Land use
- Low emission Husbandry
- Smart use of Manure
- Biobased Organic Fertilizing
- More Carbon Sequestration

Source: Prof. Martin Scholten & Dr. Jean-Louis Peyraud, presentation at conference "The role of ruminants in sustainable diets"

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Control
Evaluate
Improve

Thank you for attention!

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