# Climatic and environmental aspects in future cattle production

## Feeding

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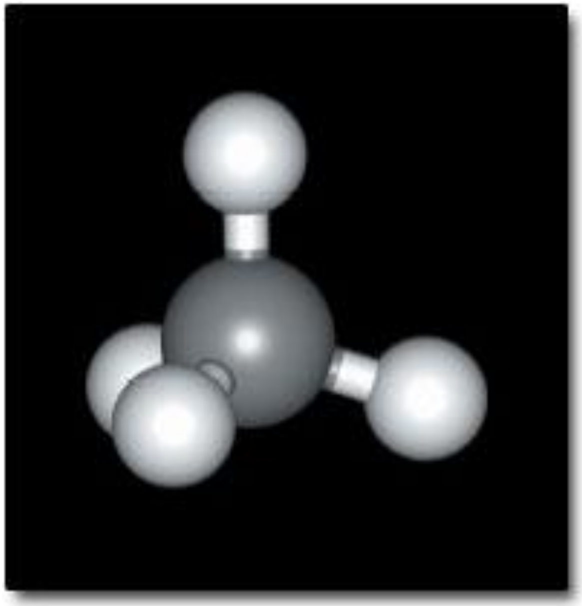
# Outline

- Phosphorus
- Nitrogen
- Methane

# Strategies to increase nitrogen utilization and decrease nitrogen losses

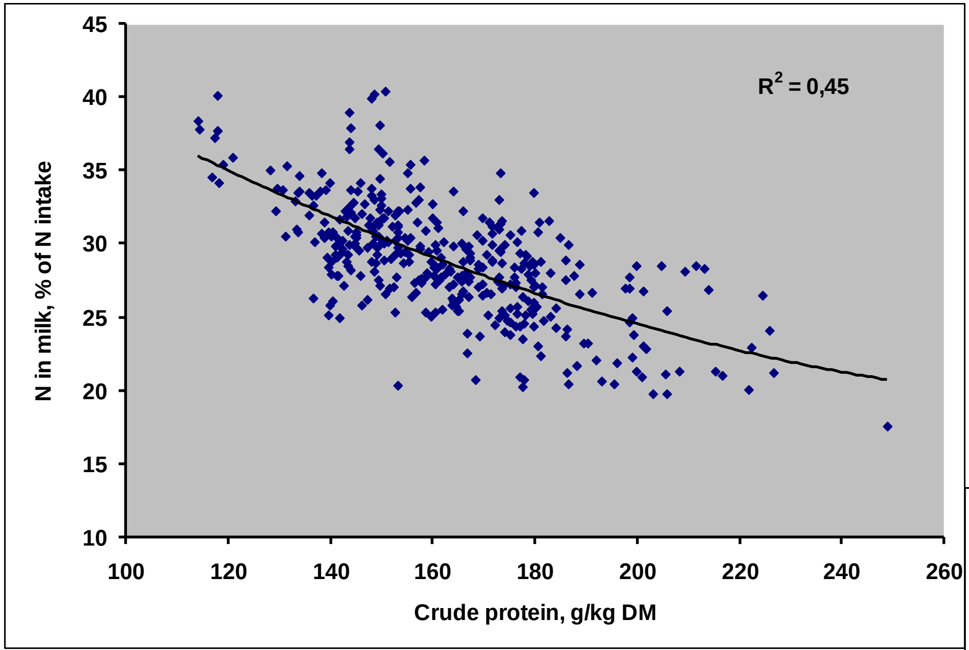
*Why*

- Optimisation of production outcome, €
- Environment and climate
  - $N_2O$ as a greenhouse gas

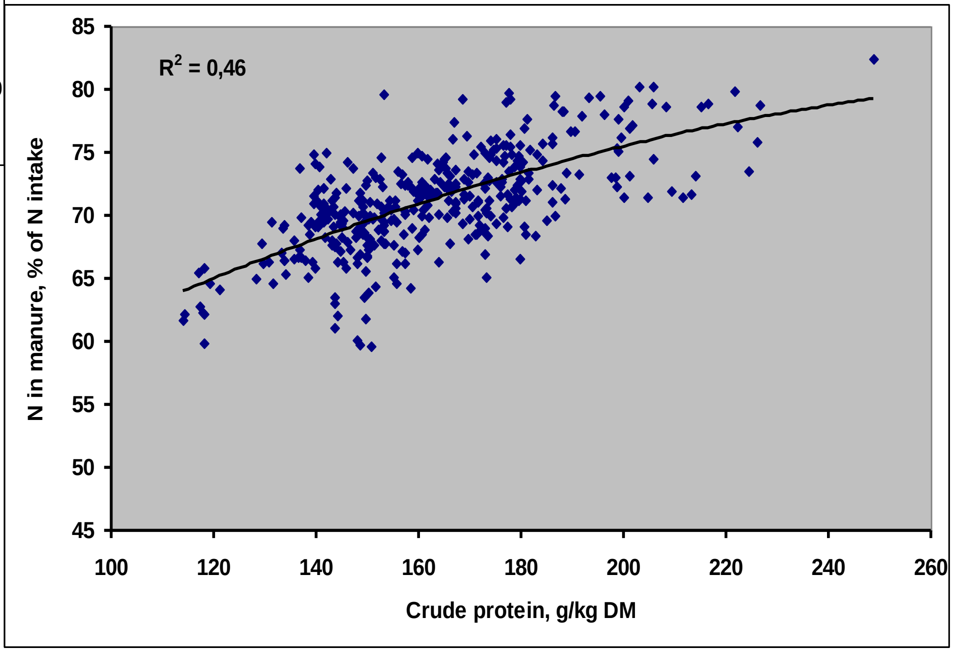
- At farm level
  - Manure management
  - Crop and production
  - Animal production level (meat and milk per unit of land or energy)

- Animal level
  - Diet formulation and N utilisation
  - Feeding strategies
  - Feed efficiency

# Proportion of N intake excreted in milk and manure

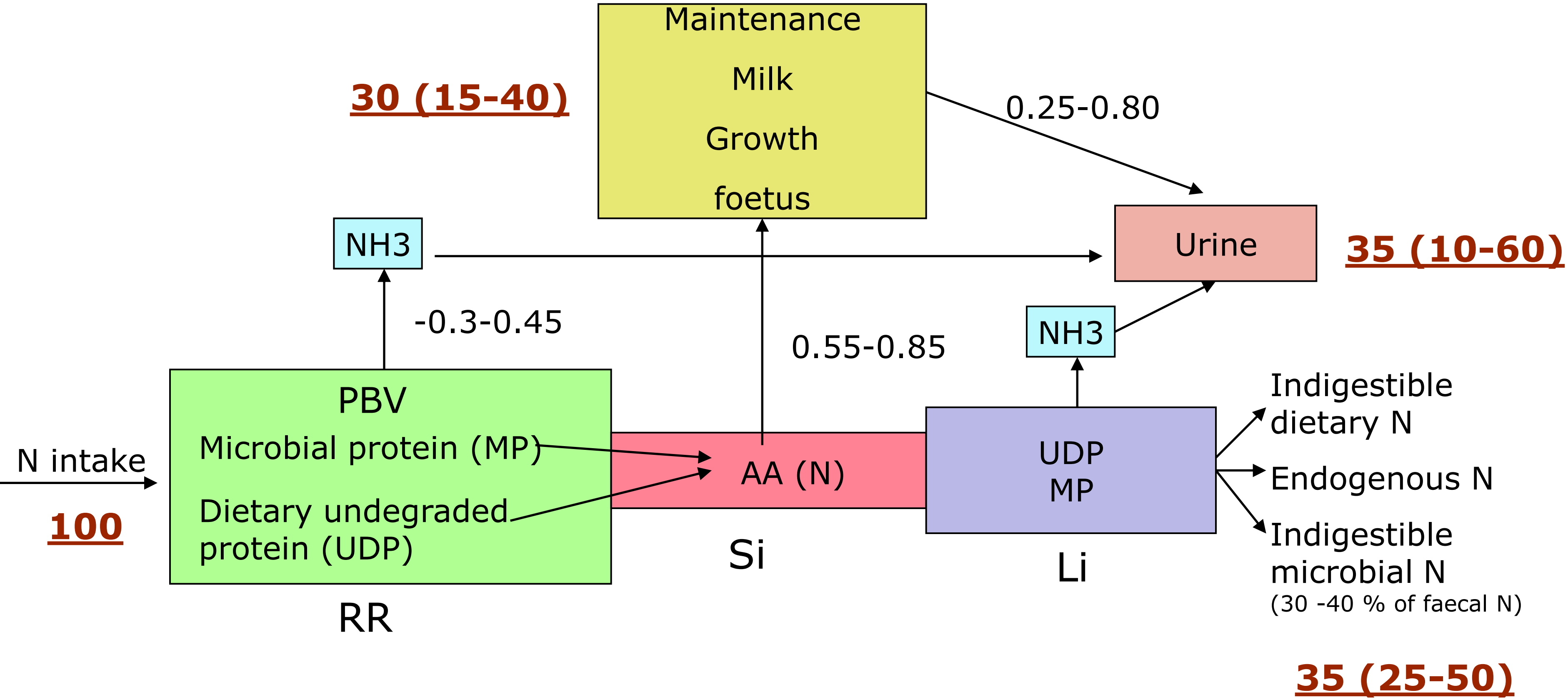



Nordic feeding experiments. 382 treatments. NorFor, 2011




Large variation within CP content: the most interesting factor

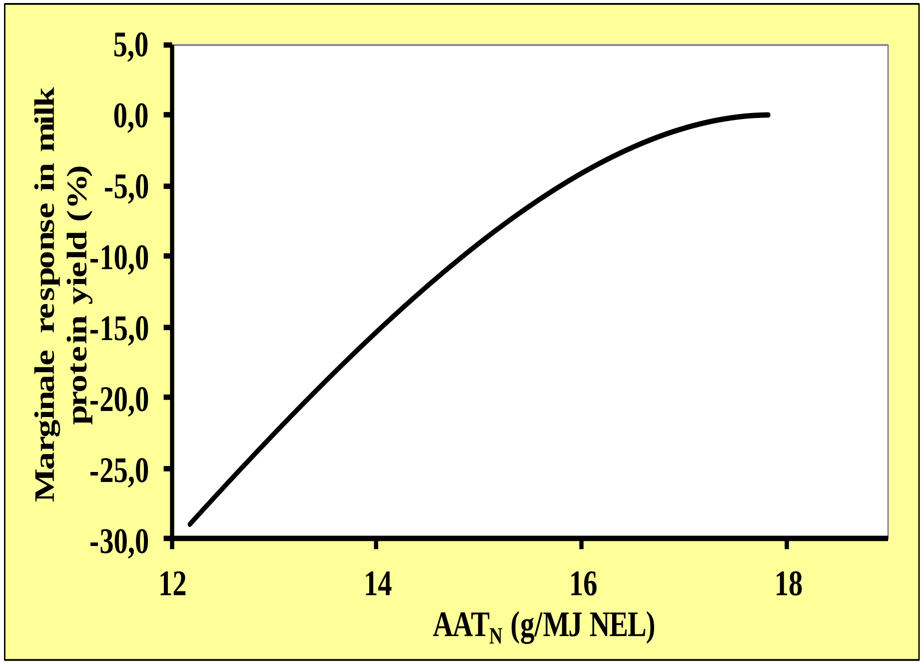
# N metabolism in ruminants

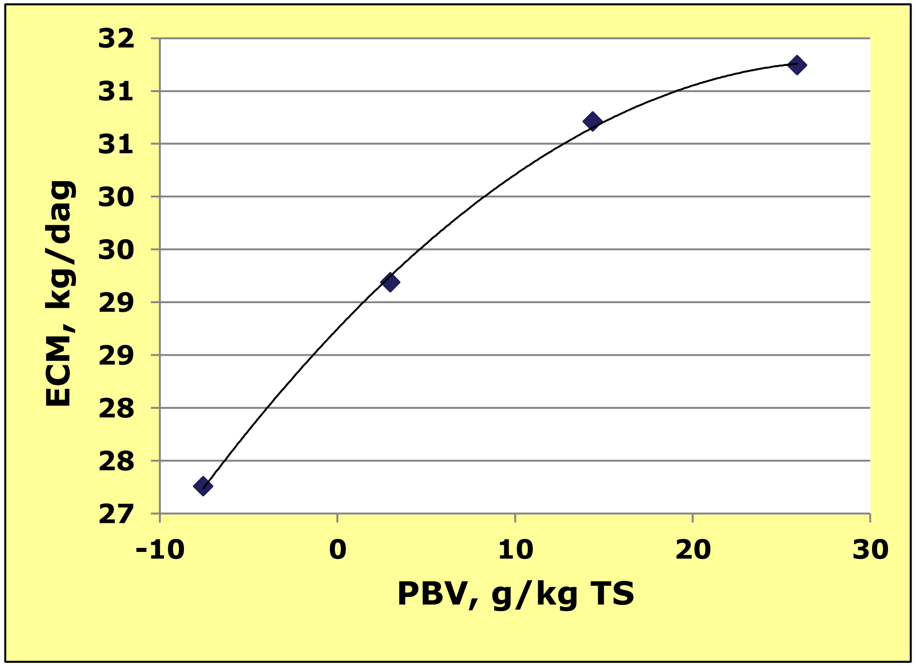


# Strategies to increase nitrogen utilization

- Optimal PBV
  - Increased rumen N efficiency
- Optimal AAT
  - Increased N efficiency in the mammary gland
  - Individual amino acids

Increased N efficiency




Volden et al., 2011,

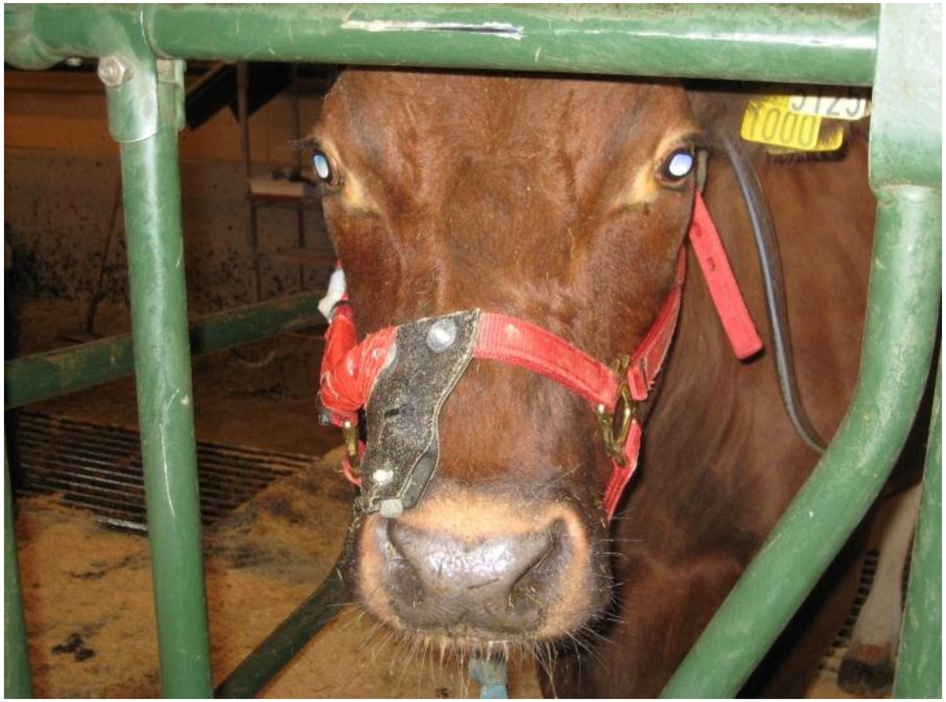
Weisberg, 2010

# Conclusion nitrogen

- Reducing dietary CP to the “requirement” will be effective for reducing excessive excretion of N
  - Especially the environmentally labile form of N
- Important to identify the crossing point between product outcome (€) and the environmentally cost to optimise our N use in animal/agricultural production
- Higher focus on ration formulation will improve the N efficiency and economic sustainability of animal production systems.

# Methane evaluation

- Evaluation of dietary factors affecting methane production
- Danish, Norwegian and Swedish experiments
- Methane prediction implemented in NorFor from August 2012



NorFor
Nordic Feed Evaluation System

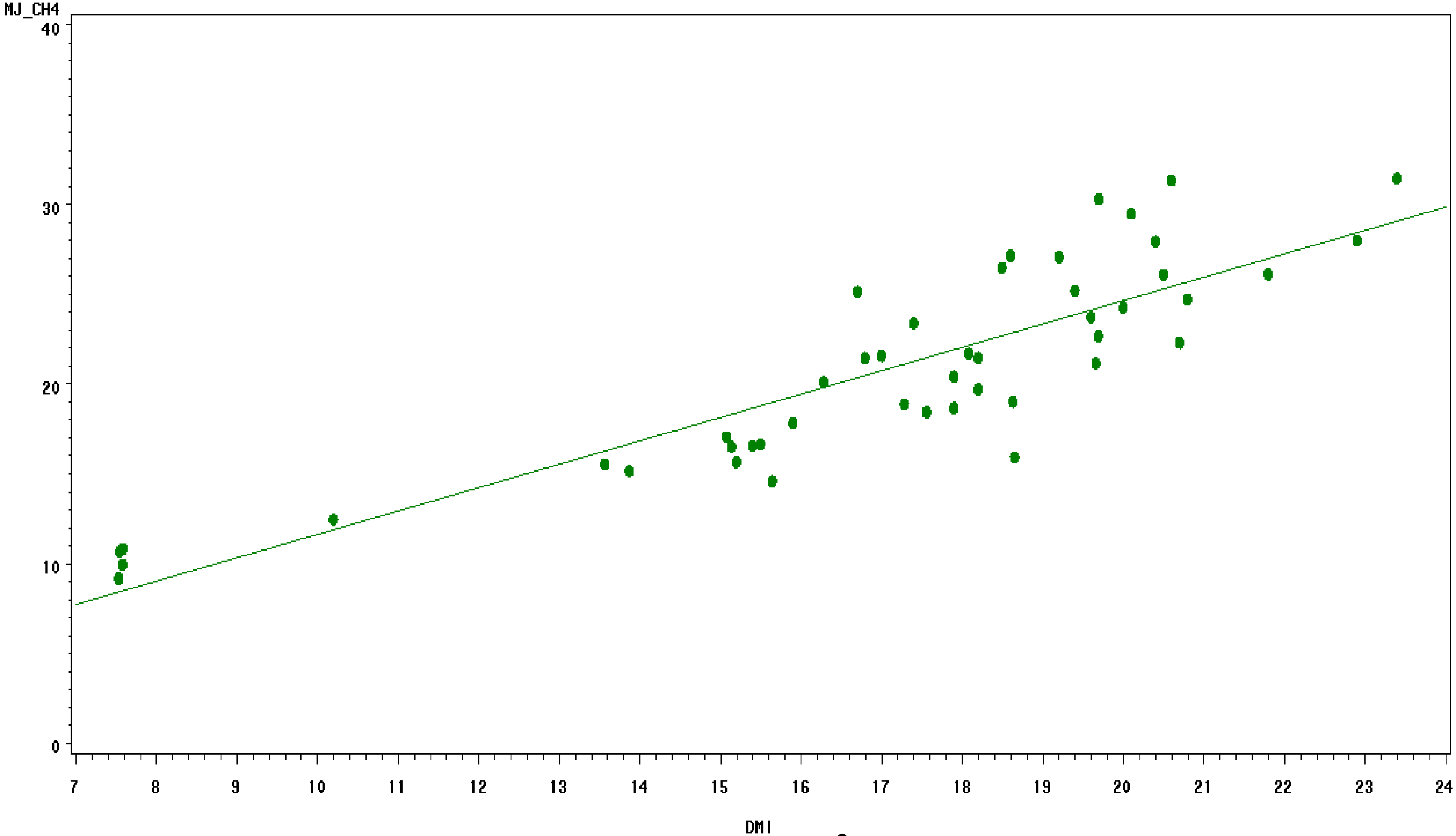
# Data description (47 obs.)

- Days in milk: 170; 92-240 days
- Body weight: 605; 553-691 kg
- Dry matter intake: 17; 8-23 kg
- Net Energy Lactation (NEL): 114; 51-152
- Energy concentration (NEL/DM): 6,7; 5,3-8,1
- Energy corrected milk (ECM): 21; 0-35 kg
- Concentrate proportion: 32; 0-51 % of DM
- Methane, % of gross energy (GE): 6,2; 4,5-8,8 %
- Starch: 156; 0-311 g/kg DM
- Fatty acids: 26; 8-53 g/kg DM
- NDF: 342; 232-539 g/kg DM

N. Nielsen, M. Åkerlind and H. Volden, unpublished

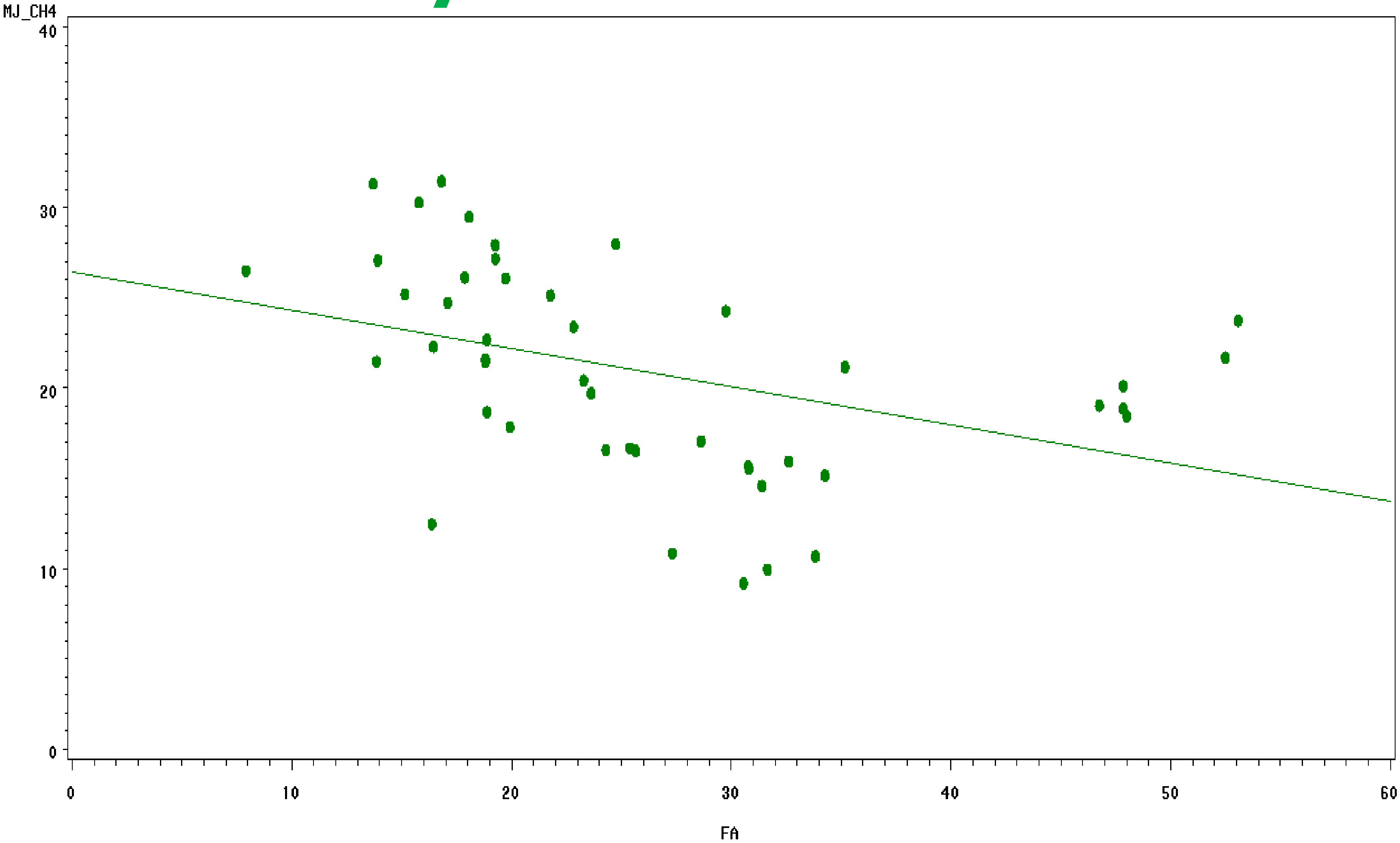
NorFor
Nordic Feed Evaluation System

# Dry matter intake and methane




N. Nielsen, M. Åkerlind and H. Volden, unpublished

# Fatty acids and methane




N. Nielsen, M. Åkerlind and H. Volden, unpublished

# The Nordic data set showed:

- No effect of NDF, starch, sugar
- No effect of concentrate proportion

# Implementation in NorFor

Metan (MJ/d) = 2,9 + 1,23*DMI – 0,116*FA
(CV=12% & $r^2$=0,80)

| | Fatty acids, 25 g/kg DM | | | | Fatty acids, 40 g/kg DM | | |
|---|---|---|---|---|---|---|---|
| Milk, kg/d | DMI | CH4, MJ/d | CH4, MJ/kg milk | | DMI | CH4, MJ/d | CH4, MJ/kg milk |
| 14 | 13.8 | 17 | 1.20 | | 13.8 | 15 | 1.08 |
| 24 | 17.9 | 22 | 0.92 | | 17.5 | 20 | 0,82 |
| 34 | 22.2 | 27 | 0.80 | | 21.8 | 25 | 0,74 |
| 44 | 26.7 | 33 | 0.75 | | 26.2 | 31 | 0,69 |

DMI = dry matter intake, kg DM/d
FA = fatty acids, gkg DM

# Conclusion methane

- The present data showed that only dry matter intake and dietary fat content significantly affected the methane production
- Increased dry matter intake reduce methane production per kg milk produced
- Increasing the dietary fatty acid concentration from 25 to 40 g/kg DM decrease methane production by 10%.
- Increased feed efficiency is an important strategy to reduce the climatic and environmental impact

# A Comparison of Protein Evaluations by the NorFor and NRC-2001 Systems

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# NRC-2001 versus NorFor: Milk Protein Yield