USE OF ON-FARM METHANE INTENSITY QUANTIFICATION AND FORAGE RELATED MITIGATION OPTIONS

Michelle Mehrens[1] and Achim Hoffmann[2]

[1] Provita Supplements GmbH, Pinneberg, DE [2] ISF GmbH, Wahlstedt, DE

INTRODUCTION

- As a by-product of enteric fermentation, ruminants account for 6% of the global anthropogenic methane (CH_4) production (Beauchemin et al. 2020)
- Due to the higher CH_4 potential of forage, an increase in quality leads to a reduction in CH_4 intensity from the forage
- High quality and digestibility of the forage enhance the digestible energy and the animal productivity
- To evaluate management decisions and their impact on farm CH_4 intensity, quantification of the actual value is necessary
- Aim: the use of easily available farm data to quantify the CH_4 intensity

QUANTIFICATION OF CH_4

- Quantification of CH_4 is possible using predictive models based on extensive datasets of animals which are based on the parameters available on farms (e.g., average feed intake, ration parameters, milk yield and milk production parameters)
- Model by Kirchgeßner et al. 1994 et al. which relates the proportions of crude nutrients (CF: intake rate of crude fiber, NFE: intake rate of N-free extracts, CP: intake rate of crude protein, CL: intake rate of ether extract) to CH_4 emissions:

$$EF_{CH4,I} = 0.079 \times CF + 0.010 \times NFE + 0.026 \times CP + (-0.212) \times CL + 0.063$$

- Based on an international data the prediction model by Niu et al. (2018) considered dry matter intake (DMI, kg/day) and neutral detergent fiber contents (NDF, % of the diet):

$$CH_4\ [g] = -26.0(16.67) + 15.3\ (0.41) \times DMI + 3.42\ (0.309) \times NDF$$

Evaluation of CH_4 intensity using practical farm data

- Descriptive data set based on daily farm data from the dairy herd of Gut Huelsenberg (Wahlstedt, DE)
- Clear negative correlation of ECM yield and CH_4 intensity (Figure 1)

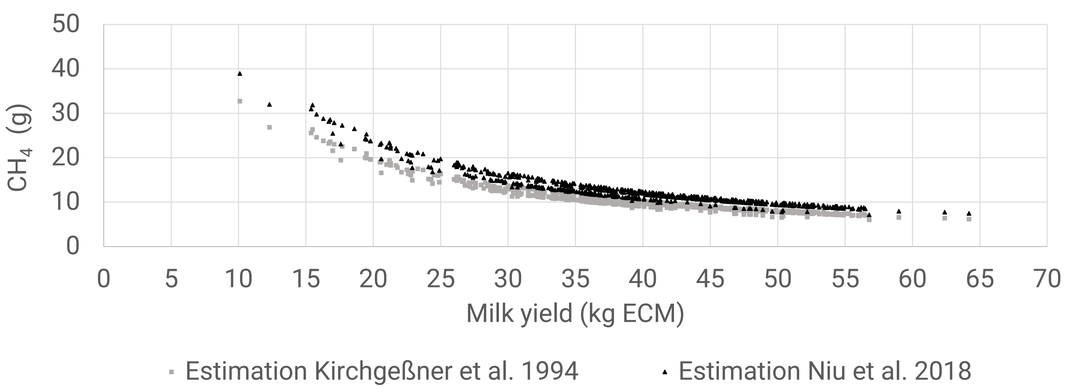

Figure 1. The CH_4 intensity g/kg energy corrected milk (ECM, 3.0 % protein and 4.0% fat) of the whole herd (200 dairy cows) was determined based on the average feed intake, milk yield and milk quantity data from 3 monthly milk recordings (period 09/22 – 11/22) using the estimation models according to Kirchgeßner et al. 1994 and Niu et al. 2018

- Cows with lower feed intake and lower milk quantity emit more CH_4/kg ECM than cows with higher milk quantity (Figure 2)
- Cows with lower feed intake and higher milk yield
  → high efficiency, less CH_4/kg ECM (Figure 2)

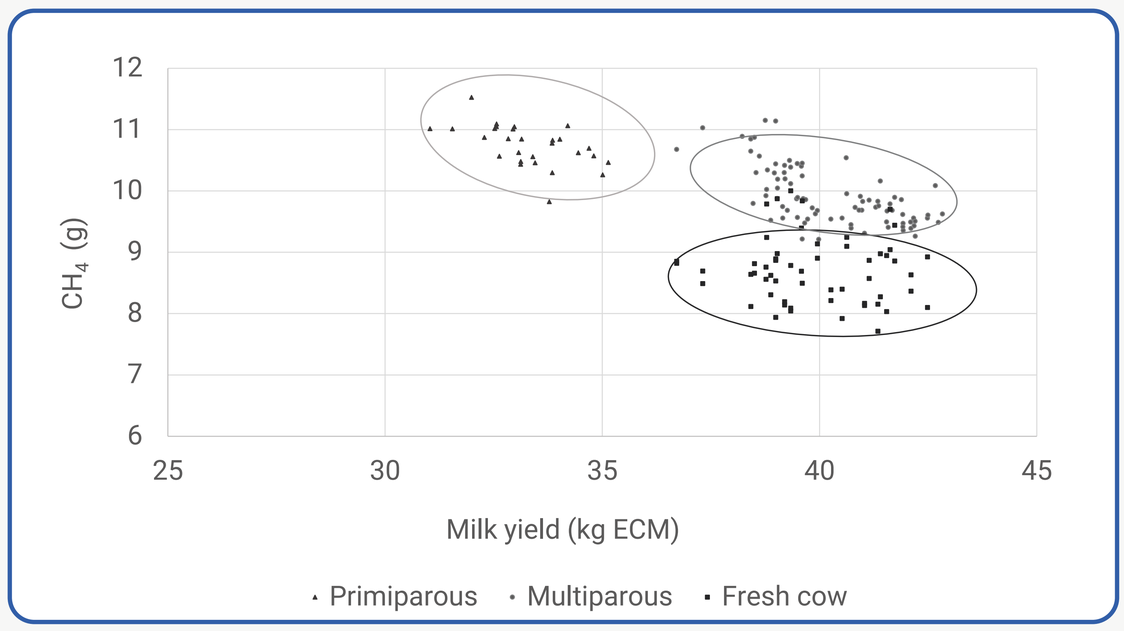

Figure 2. Further calculation on the average CH_4 intensity of the different performance groups using the estimation of Kirchgeßner et al. (1994) over a 4-week period reveals differences based on parity (primiparous cows compared to multiparous cows) and lactation period (fresh cow)

APPLIED IMPLICATION – IMPROVEMENT OF THE FORAGE UTILIZATION EFFICIENCY

- Optimization of the ruminal fermentation performance offers huge potential in dairy diets
- Silage conservation using inoculants based on homo- and heterofermentative lactic acid bacteria has been proven to support the digestibility beside the improved fermentation process and aerobic stability
- Using a fungal fermentation product with a vast range of exogenous fibrolytic enzymes in ruminant diets, offers the possibility to improve the nutrient utilization and support production performance
- The applications of fungal fermentation products have shown potential benefits in an in vivo trail performed by the University of Pelotas in 2019:
  - The supplementation of the diet with the test material (MAXFIBER) reveals an improved milk yield (kg/d, $p = 0.05$) and improved feeding performance (frequency of trough access and meals per day, $p < 0.01$) → higher efficiency

CONCLUSION

- **Estimation formulas can provide a practical tool to assess the on-farm situation regarding enteric fermentation and carbon footprint**
- **The overall goal should be to increase feed efficiency at a maximized roughage feed portion and the animal performance without negatively impacting animal welfare and health**
- **It was shown that the addition of SSF products (esp. MAXFIBER) and silage inoculants (BONSILAGE) increase feed efficiency**
- **An increased milk yield results in reduced CH_4 intensity/kg ECM and allows a reduced total number of animals, which would positively impact global CH_4 emissions from enteric fermentation**

PERFECT COMPONENTS. MAXIMUM RESULTS.