Effect of grass silages, differing in maturity and nitrogen fertilisation, on in vitro methane production

F.M. Macome1,2, W.H. Hendriks1,2, J. Dijkstra1, D. Warner1, W.F. Pellikaan1, J.W. Cone1, J.T. Schonewille2
1Animal Nutrition Group, Wageningen University
2Faculty of Veterinary Medicine, Utrecht University
felicidade.macome@wur.nl

Background
Methane (CH₄), production by has received considerable attention in recent years due its contribution to global warming. Moreover, CH₄ synthesis in the rumen represent a significant loss of dietary energy.

Objectives
- To determine in vitro CH₄ production of grass silages differing in maturity and N-fertilisation rate when incubated with rumen fluid from donor cow adapted to specific feed & non-adapted rumen inoculum from cows not adapted to specific feed.
- To compare in vitro results with the in vivo data on CH₄ production measured simultaneously using donor cows adapted to each grass silage.

Materials & Methods
- Grass fields (predominantly rye grass) were fertilized with low N (L: 65 kg N/ha) or high N (H: 150 kg N/ha).
- Each grass field was harvested at early maturity (EM), mid maturity (MM) and late maturity (LM), and ensiled.
- Donor cows were fed with these 6 grass silages (n = 2) as part of complete ration.
- Complete ration consists of 80% (DM basis) grass silage and 20% concentrate.

Table 1. Effect of maturity and N-fertilization on chemical composition (g/kg of DM) of grass silages.

<table>
<thead>
<tr>
<th>Low N</th>
<th>High N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EM</td>
</tr>
<tr>
<td>DM yield (kg/ha)</td>
<td>2023</td>
</tr>
<tr>
<td>OM</td>
<td>903</td>
</tr>
<tr>
<td>CP</td>
<td>149</td>
</tr>
<tr>
<td>Sugars</td>
<td>98</td>
</tr>
<tr>
<td>NDF</td>
<td>476</td>
</tr>
<tr>
<td>ADF</td>
<td>282</td>
</tr>
<tr>
<td>ADF</td>
<td>20</td>
</tr>
</tbody>
</table>

- Gas production was measured using a fully automated system (Cone et al., 1996).
- In vitro CH₄ production was measured using automated gas production techniques as described by Pellikaan et al. (2011). In vivo CH₄ data were measured in climate controlled respiration chambers.

Conclusions
- Gas production decreased with advancing maturity.
- CH₄ production was affected by maturity and N fertilisation.
- In vitro CH₄ production showed a weak correlation with the in vivo CH₄ expressed in (ml/g OM).

Results

Figure 1. Gas and CH₄ production of grass silages differing in maturity after 72h of incubation either adapted or mixed rumen fluid.

Figure 2. Effect of fertilisation level of grass silages on gas and CH₄ production after 72h of incubation either adapted or mixed rumen fluid.

Figure 3. Relationship between in vivo and in vitro CH₄ measured from cows fed grass silages differing in maturity and N fertilisation rates.

References