COMPARISON OF METHODS FOR ESTIMATING HERBAGE INTAKE IN GRAZING DAIRY COWS

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BACKGROUND

- The number of dairy cows on summer grass has decreased in Denmark
- Advantages of a system where cows are grazing
  - Reduction in mortality
  - Reduction in lesions on legs
- Why are the cows not grazing
  - Herd size
  - Access to grass
  - How much grass does the cow eat?

Source: Jens Tønnesen - Landbrugsavisen
AIM

To compare different methods for estimating herbage intake of cows grazing seven hours daily
DESIGN

- Two seasons (spring and autumn)
- Two measuring periods in each season
- Two stocking rates each season (low (LS) and high (HS))
- Twenty cows per season
- Cows grazing seven hours daily and fed a mixed ration ad libitum in barn
- Observation of behaviour (standing, laying and grazing activity)
EXPERIMENTAL SCHEDULE

Seven days of adaptation to grazing and diet

First collection period (days 1-8)

Second collection period (days 10-15)

Samples
- Dry matter intake barn
- Milk samples
- Grab samples of faeces
- Grass samples
- Observation of cow behaviour
STOCKING RATE

• Spring
  • LS: 0.75 hectare/cow
  • HS: 0.57 hectare/cow

• Autumn
  • LS: 1.42 hectare/cow
  • HS: 1.08 hectare/cow

LS = low stocking rate
HS = high stocking rate

MIXED RATION

Values are given in g/kg

<table>
<thead>
<tr>
<th>Mixed ration</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>dry matter</td>
<td></td>
</tr>
<tr>
<td>Maize silage</td>
<td>538</td>
</tr>
<tr>
<td>Sugar beet pellets</td>
<td>251</td>
</tr>
<tr>
<td>Rape seed cake 11.5 % fat</td>
<td>143</td>
</tr>
<tr>
<td>Sugar cane molasses</td>
<td>50</td>
</tr>
<tr>
<td>Calcium carbonate</td>
<td>7</td>
</tr>
<tr>
<td>Minerals</td>
<td>7</td>
</tr>
<tr>
<td>Vitamins</td>
<td>4</td>
</tr>
</tbody>
</table>
METHODS USED TO ESTIMATE HERBAGE INTAKE

Spring

- Animal performance (NE)
- Intake capacity (IC)
- Stable isotope ($^{13}$C)
  - No assumptions (C13-1)
  - Assumption of discrimination in intestinal tract (C13-2)
  - Assumption of discrimination and digestibility (C13-3)
- Combination of two internal markers, INDF/ADL (INDF-ADL)

Autumn

- Same as spring plus
- Autumn - Single pulse dose of external marker fed in concentrate ($\text{TiO}_2$)
  - $\text{TiO}_2$ together with in vitro organic matter digestibility (Ti-OM)
  - $\text{TiO}_2$ together with ADL (Ti-ADL)
  - $\text{TiO}_2$ together with INDF (Ti-INDF)
### CHEMICAL COMPOSITION

<table>
<thead>
<tr>
<th></th>
<th>Mixed ration&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Spring Herbage&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Autumn Herbage&lt;sup&gt;2&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter (g/kg)</td>
<td>463</td>
<td>218</td>
<td>190</td>
</tr>
<tr>
<td>Ash (g/kg DM)</td>
<td>66</td>
<td>71</td>
<td>85</td>
</tr>
<tr>
<td>Crude protein (N*6.25)(g/kg DM)</td>
<td>141</td>
<td>131</td>
<td>187</td>
</tr>
<tr>
<td>Crude fat (g/kg DM)</td>
<td>53</td>
<td>27</td>
<td>41</td>
</tr>
<tr>
<td>NDF (g/kg DM)</td>
<td>325</td>
<td>409</td>
<td>437</td>
</tr>
<tr>
<td>INDF (g/kg DM)</td>
<td>68</td>
<td>39</td>
<td>65</td>
</tr>
<tr>
<td>ADL (g/kg DM)</td>
<td>32</td>
<td>15</td>
<td>21</td>
</tr>
<tr>
<td>INDF/ADL</td>
<td>2.1</td>
<td>2.6</td>
<td>3.1</td>
</tr>
<tr>
<td>Organic matter digestibility (g/100 g)</td>
<td>78.7</td>
<td>82.5</td>
<td>74.8</td>
</tr>
<tr>
<td>&lt;sup&gt;13&lt;/sup&gt;C (δ)</td>
<td>-18.80</td>
<td>-29.00</td>
<td>-28.98</td>
</tr>
</tbody>
</table>

<sup>1</sup> Average between spring and autumn  
<sup>2</sup> Average between stocking rates
MILK YIELD AND DRY MATTER INTAKE BARN

Yield, energy corrected milk
- Spring: 27.9 kg
- Autumn: 29.0 kg

Dry matter intake barn
- Spring: 12.5 kg
- Autumn: 16.4 kg
HERBAGE INTAKE

Kg herbage DM

Spring
Autumn

NE  IC  C13-1  C13-2  C13-3  Ti-OM  Ti-INDF  Ti-ADL  INDF-ADL

-17.4

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AARHUS UNIVERSITY

EAAP
25 AUGUST 2014
ACTIVITY ON GRASS

- **Grassing activity**
  - Spring: 50%
  - Autumn: 40%

- **Standing**
  - Spring: 20%
  - Autumn: 11%

- **Lying**
  - Spring: 30%
  - Autumn: 49%

Legend:
- **Spring**
- **Autumn**
CORRELATION BETWEEN METHODS - SPRING

<table>
<thead>
<tr>
<th></th>
<th>DMI$_{\text{Herb-C13-3}}$</th>
<th>DMI$_{\text{Herb-INDF-ADL}}$</th>
<th>Grazing time</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMI$_{\text{Herb-NE}}$</td>
<td>-0.02</td>
<td>0.12</td>
<td>0.41</td>
</tr>
<tr>
<td>DMI$_{\text{Herb-C13-3}}$</td>
<td></td>
<td>0.10</td>
<td>0.30</td>
</tr>
<tr>
<td>DMI$_{\text{Herb-INDF-ADL}}$</td>
<td></td>
<td></td>
<td>0.44</td>
</tr>
</tbody>
</table>
## CORRELATION BETWEEN METHODS - AUTUMN

<table>
<thead>
<tr>
<th></th>
<th>$\text{DMI}_{\text{Herb-C13-3}}$</th>
<th>$\text{DMI}_{\text{Herb-Ti-OM}}$</th>
<th>$\text{DMI}_{\text{Herb-Ti-INDF}}$</th>
<th>$\text{DMI}_{\text{Herb-Ti-ADL}}$</th>
<th>$\text{DMI}_{\text{Herb-INDF-ADL}}$</th>
<th>Grazing time</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\text{DMI}_{\text{Herb-NE}}$</td>
<td>0.31</td>
<td>0.12</td>
<td>-0.25</td>
<td>-0.10</td>
<td>-0.16</td>
<td>0.40</td>
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<tr>
<td>$\text{DMI}_{\text{Herb-C13-3}}$</td>
<td></td>
<td>0.28</td>
<td>-0.03</td>
<td>0.28</td>
<td>-0.30</td>
<td>0.55</td>
</tr>
<tr>
<td>$\text{DMI}_{\text{Herb-Ti-OM}}$</td>
<td></td>
<td></td>
<td>0.65</td>
<td>0.58</td>
<td>0.01</td>
<td>0.64</td>
</tr>
<tr>
<td>$\text{DMI}_{\text{Herb-Ti-INDF}}$</td>
<td></td>
<td></td>
<td></td>
<td>0.29</td>
<td>0.52</td>
<td>0.27</td>
</tr>
<tr>
<td>$\text{DMI}_{\text{Herb-Ti-ADL}}$</td>
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<td></td>
<td></td>
<td></td>
<td>-0.64</td>
<td>0.28</td>
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<tr>
<td>$\text{DMI}_{\text{Herb-INDF-ADL}}$</td>
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<td></td>
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<td>-0.06</td>
</tr>
</tbody>
</table>
CONCLUSION

- Herbage intake differed between methods
- The correlation between methods where low

Which method gives the "correct" herbage intake?
Thank you for your attention