Substitution rate between forage supplement and grazed pasture in dairy cows: a meta-analysis

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Background

Grazing is amazing:
- High-quality forage (E and N)
- Lowest cost of production

but
- periods of pasture shortage (summer, autumn)
- limited grazing area with large herds

very frequent « mixed diets »: grazing/conserved forage

Nutritional effects of a forage supplementation?

Forage intake $\Rightarrow$ less pasture intake $\Rightarrow$ more milk?
Literature for Forage $<<<<$ for Concentrate
Definitions
Two ways for managing grazing when cows are supplemented

No supplement

Supplement at same PA

Supplement at less PA

Pasture utilisation /ha

High

Low

High

Approach:

« scientific »

« practical »
Objective of the meta-analysis

Forage supplementation
- Nature
- Amount

Grazing management
- Pasture allowance

Substitution rate and milk production response of dairy cows
Methodology

- Only within-experiment animal responses (without FO) vs. (with FO) treatments

- Required data: pasture intake, milk, herbage allowance
  Filtering: Temperate regions
  No concentrate variation
  No restriction of daily access time

- Database split in two parts:
  D1: Same PA between Control and Exp: « scientific »
  D2: Less PA in Exp than in Control: « practical »
Results – D1: Same PA

+ 4.6 kg DM forage, Low PA : 25 kg DM/d

<table>
<thead>
<tr>
<th>Supplement type</th>
<th>Total</th>
<th>Maize silage</th>
<th>Pasture silage</th>
<th>Hay</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=62</td>
<td>n=34</td>
<td>n=12</td>
<td>n=16</td>
</tr>
<tr>
<td>Substitution rate</td>
<td>0.40 ± 0.29</td>
<td>0.36</td>
<td>0.31</td>
<td>0.51</td>
</tr>
<tr>
<td>kg DM /kg DM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milk yield response</td>
<td>0.39 ± 0.31</td>
<td>0.53</td>
<td>0.30</td>
<td>0.22</td>
</tr>
<tr>
<td>kg milk /kg DM</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
## Results – D1: Same PA

<table>
<thead>
<tr>
<th>Substitution rate with PA (+ 0.17 per 10 kg of PA)</th>
<th>From 0.2 to 1.0 from Low to High PA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize silage</td>
<td></td>
</tr>
<tr>
<td>Pasture silage</td>
<td></td>
</tr>
<tr>
<td>Hay</td>
<td></td>
</tr>
</tbody>
</table>
Results – D2: Less PA

+ 7.3 kg DM forage, - 19 kg/d PA, -2.7 kg PA/kg forage

<table>
<thead>
<tr>
<th>Database</th>
<th>D2 Less PA</th>
<th>D1 Same PA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=52</td>
<td>n=62</td>
</tr>
<tr>
<td>Substitution rate (kg DM /kg DM)</td>
<td>0.79 ± 0.38</td>
<td>0.40 ± 0.29</td>
</tr>
<tr>
<td>Milk yield response (kg milk /kg DM)</td>
<td>-0.13 ± 0.33</td>
<td>0.39 ± 0.31</td>
</tr>
</tbody>
</table>

Less PA: ↗ substitution rate, resulting from the cumulative effects of supplementation AND of less PA
Substitution rate (kg DM/kg DM)

Milk yield response (kg milk/kg DM)

Less PA: overall translation to more substitution and less milk response
Conclusions

- Large variations of substitution pasture/forage (from 0 to 1) largely explained by PA

- At same PA, positive milk response to forage supplement

- But in practice, no milk response to forage supplement
  High pasture utilisation = \( \downarrow \) PA = \( \uparrow \) substitution

Practical implication
- No interest to supplement cows with a conserved forage if no pasture deficit at farm level

Maximise the use of grazing on dairy farms !!!
Thank you for your attention