Relationships between cow performance with milk urea yield and efficiency of protein utilization

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N cycle on dairy systems

- N supplementary feed
- N rain
- N fixation
- N fertilization
- N harvested
- N milk
- N excreted

Inputs

N surplus

Outputs

Leaching
Denitrification
Volatilization
Organization

(Peyraud & Delaby 2006)
Investigate relationships of cow performance with milk urea (MU) and efficiency of crude protein utilization (ECPU) in two contrasting grazing herds in New Zealand
Materials and methods

- Dairy systems
  - Animal performance
  - Feed quality records

Massey University Dairy 1 – Low supplement
- OAD full season
- DairyNZ System 1: 93% pasture fed
- 120 ha; 100 RG-WC pasture, 10 lucerne, 10 mixed-herb
Materials and methods

- Dairy systems
- Animal performance
- Feed quality records

Massey University Dairy 4 – High supplement
- TAD full season
- DairyNZ System 4: 55% pasture fed
- 250 ha; 100% RG-WC pasture with summer crop
- Maize and pasture silage, concentrate
Materials and methods

- Dairy systems

- Animal performance

- Feed quality records

Animal measurements
- Live weight

Herd test records and milk sampling
- Milk production
- Milk solids composition
- Milk urea
- Somatic Cell Count
Materials and methods

- Dairy systems
- Animal performance
- Feed quality records

Pre- and Post-grazing for DM intake allocation
  - Ryegrass – White clover pasture: Rising plate meter
    - Crops: Quadrat cuts

Hand-plucking samples for feed quality
  - Nutritive values
  - Botanical composition
  - % Dry Matter
Results

Low Supplement

Early lactation stage
11.7 MJ ME
18.3 % CP

Mid lactation stage
11.1 MJ ME
19.9 % CP

Late lactation stage
9.5 MJ ME
21.1 % CP

High Supplement

Early lactation stage
11.3 MJ ME
14.5 % CP

Mid lactation stage
11.0 MJ ME
14.9 % CP

Late lactation stage
10.6 MJ ME
16.3 % CP
## Results: cow performance (I)

<table>
<thead>
<tr>
<th></th>
<th>Low supplement</th>
<th>High supplement</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>258</td>
<td>210</td>
<td></td>
</tr>
<tr>
<td>Days in milk</td>
<td>270</td>
<td>272</td>
<td>0.636</td>
</tr>
<tr>
<td>Live weight, kg</td>
<td>487</td>
<td>502</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>BCS</td>
<td>4.6</td>
<td>4.2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Milk yield, kg</td>
<td>4,206</td>
<td>5,387</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Milksolids yield, kg</td>
<td>385</td>
<td>448</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Fat yield, kg</td>
<td>216</td>
<td>247</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Protein yield, kg</td>
<td>170</td>
<td>202</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Lactose yield, kg</td>
<td>211</td>
<td>300</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>CP intake, kg/cow/season</td>
<td>703</td>
<td>617</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Efficiency of CP utilization, %</td>
<td>25.3</td>
<td>33.6</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Milk urea, mg/dL</td>
<td>28.3</td>
<td>21.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Milk urea yield, g</td>
<td>1208</td>
<td>1269</td>
<td>0.111</td>
</tr>
</tbody>
</table>
Results

**Daily yield (kg milk/cow)**

**Protein yield (kg/cow)**

\[ r_p = 0.93 \]

- **Low supplement**
- **High supplement**
Results

Daily yield (kg milk/cow)

Week

Protein yield (kg/cow)

Week

Efficiency of CP utilization (%)

Days in milk

Low supplement

High supplement

$\text{r}_p = 0.93$

$\text{r}_p = 0.17$

$\text{r}_p = 0.22$
Results

- **Daily yield (kg milk/cow)**
  - Low supplement vs. High supplement

- **Protein yield (kg/cow)**
  - $r_p = 0.39$
  - $r_p = 0.35$

- **Efficiency of CP utilization (%)**
  - $r_p = 0.15$

- **Days in milk**
  - **Efficiency of CP utilization**
    - Low supplement (green)
    - High supplement (orange)

- **Milk yield (kg milk/cow season)**
  - **Milk urea (mg/dL)**
  - Comparison of low and high supplement groups
Results

**Milk yield (kg milk/cow season)**
- **Low supplement**
- **High supplement**

**Milk urea yield (g/cow season)**
- $r_p = 0.80$

**Efficiency of CP utilization (%)**
- $r_p = 0.18$

**Daily yield (kg milk/cow)**
- $r_p = 0.15$

Daily yield (kg milk/cow season) vs. Milk urea yield (g/cow season)

Days in milk vs. Efficiency of CP utilization (%)

Week vs. Milk yield (kg milk/cow season)
Conclusions

- Efficiency of CP utilization of low supplement herd was reduced due to lower milk yield and higher CP% in diet

- No clear linear association between the efficiency of CP utilization and MU

- Body reserves mobilization may contribute to N requirements

- Our definition of efficiency of CP utilization does not describe in full N use efficiency and N losses of grazing systems. Part of N not seen in milk may be stored in body reserves
Acknowledgements

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School of Veterinary Science
Many thanks