Grazing with a high stocking density

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Grazing in the Netherlands

% Dutch dairy cows grazing

Years

100 90 80 70 60 50 40 30 20 10 0


CBS, 2016

Main reasons:

• Increase in stocking density
• More automation
• To control feed intake and manure distribution
Social demand for grazing

- Contributes to:
  - Image Dutch dairy sector
  - Typical Dutch landscape

- Goal of Dutch government:

  80% of Dutch dairy cows should graze in 2020
What about economic effects?

- Grazed grass is the cheapest source of feed

- Economic benefits of grazing (Evers et al., 2008; Van den Pol-van Dasselaar et al., 2014)
  - Increase with an increase in fresh grass intake
  - Dependent on grassland management
Importance of good grassland management

- Focus on grassland management
- Large variation in grassland productivity

- 35 to 69 MJ $\text{NE}_L$ ha$^{-1}$ * $n=25$ Dutch dairy farms, 2012-2014

*$\text{NE}_L$ = net energy for lactation
*Fertilization level: 225 kg N ha$^{-1}$
How to graze with high stocking density?

- economic challenges -

- Small home plot: restricted fresh grass allowance

- Optimize fresh grass intake
  - Adjust additional feeding
  - Minimize trampling damage
  - Minimize rejected areas (excreta)
How to graze with high stocking density?

- *environmental challenges*

- Different nutrient losses in barn and pasture
  (Van Bruggen et al., 2010; Vellinga et al., 2011)

\[ \text{NH}_3 \uparrow \quad \text{NO}_3^- \uparrow \]

- Clustering of excreta in pasture: higher potential leaching
  - Minimize nutrient leaching
Aim of the study

- To analyse the effect of potential grazing systems on:

  - Economic performance
    - Grass production
    - Grass allowance
    - Grass intake
  - Environmental performance
    - Manure division barn/pasture
    - Manure distribution in pasture
Two potential grazing systems

- **Continuous Rotational Stocking (CRS)**
  - 6 day rotation
  - Fixed fences

- **Strip grazing (SG)**
  - 30 day rotation
  - Moving back and front wire

Both daily rotational systems
- Reduce selective grazing and clustering of excreta

- **CRS**
  - 6 day rotation
  - Fixed fences

- **SG**
  - 30 day rotation
  - Moving back and front wire
Grazing trial – Dairy Campus Leeuwarden (NL)
Set up grazing trial

- 60 milking cows on 8 ha = 7.5 cows ha\(^{-1}\)
- 7 hours per day
- Additional feeding: maize, concentrates
- **2016** and 2017: April-October
How much manure ends up in pasture?

- Measured 136 fresh manure patches
  - Height: ruler
    - 10 times per manure patch
  - Surface: flat-o-meter with 3 cm squares

Total manure exposure = volume per manure patch * # patches
How is this manure distributed in pasture?

- Recorded GPS coordinates of manure patches
  - CRS: 12 blocks
  - SG: 12 strips

- Chi-square test for equal distribution of manure patches
## Manure exposure to pasture

<table>
<thead>
<tr>
<th>Manure patch characteristics</th>
<th>Unit</th>
<th>Average</th>
<th>Min-Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>cm</td>
<td>3.2</td>
<td>1.3-7.0</td>
</tr>
<tr>
<td>Surface</td>
<td>cm²</td>
<td>651</td>
<td>234-1,656</td>
</tr>
<tr>
<td>Volume</td>
<td>cm³</td>
<td>2,017</td>
<td>307-4,334</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of patches</th>
<th>Unit</th>
<th>Average</th>
<th>Min-Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per grazing day</td>
<td>#</td>
<td>64</td>
<td>16-95</td>
</tr>
<tr>
<td>Per cow per day</td>
<td>#</td>
<td>4</td>
<td>1-6</td>
</tr>
</tbody>
</table>

1.8 m³ solid manure in pasture per cow per 7 months

23% solid manure in pasture (7 h)
Manure distribution in pasture

- 12 CRS blocks: 10 not homogeneous
- 12 SG strips: 10 not homogeneous
Reasons for heterogeneous distribution

- More manure patches at entrance pasture
  - Cows enter/exit at same place
  - Cows gather at entrance
    - Before milking
    - During rainy weather

- With CRS more clusters of manure patches
  - More herding behaviour
Concluding remarks

- 23% solid manure in pasture for CRS and SG
  - Related to grazing time

- No significant difference between CRS and SG
  - CRS and SG improvement compared to conventional stocking
  - Further improvement: design cow traffic

- Impact on:
  - Grass production, allowance and intake
  - Economic and environmental performances
Good grassland management requires a helicopter view