Why making high quality Red Clover Silage needs special care

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‘Lucerne is the Queen of forages and the lawyer of the devil at the same time’
Keith Bolsen Kansas State University

Why Red Clover Silage?
- With careful management
  - Produces high yield
  - Produces quality silage
- Red Clover has
  - higher nutritional value
  - higher voluntary intake

Key Points
- Cutting
- Wilting
- Ensiling
- Analysing
- Feeding
Key Problems for Ensiling

- Leaf Shatter
- High Buffering Capacity
- Low WSC

Typical Crop Quality - Red Clover

- DM % 28.0
- Starch % 2.0
- ADF % 25.9
- NDF % 35.8
- Buffering meq/kg 549
- Sugar % 5.9
- Protein % 22.3

Effect of Buffering Capacity on pH Decline

- Proteolytic Clostridia
- Saccharolytic Clostridia
- Enterobacteria

Forage Buffering Capacity (meq/kg)

- Red clover
- Hybrid ryegrass

1.6 FM
**SUGAR**

WSC Requirements for silage making

At 20% DM

Untreated 3.0 % fresh or 150 g/kg DM

Inoculated 2.0 % fresh or 100 g/kg DM

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**Cutting Red Clover**

- Avoid using conditioners
- Rake before dew rises
- Wilt rapidly to 30% DM
- Maximum Wilt 48 h
The ideal legume swath mooler

Inoculants?

Ensiling mixed Red Clover Swards (1.57% WSC, 22%CP)
Mean of 3 Trials

Control  Inoculated

RT. Merger working width 21 - 31 - 40 ft
Ensiling mixed Red Clover Swards (1.57% WSC, 22%CP) Mean of 3 Trials

Red Clover Protein-N

Untreated Inoculated

Sheep Trials red Clover

Untreated Inoculated
**Fermentation**

- **Inoculant**
  - Lactic acid
  - + H₂O

- **Fresh grass**
  - Sugars
  - Acetic acid
  - CO₂
  - Mannitol
  - Methanol
  - Homofermentative
  - Heterofermentative

- **Silage**
  - Lactic acid
  - 2 H₂O

**Additives and silage WSC**

<table>
<thead>
<tr>
<th></th>
<th>pH</th>
<th>Ammonia-N (g/kg TN)</th>
<th>Lactic Acid (g/kg DM)</th>
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<tbody>
<tr>
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Heterofermentative = L. buchneri, L. brevis
Homofermentative = L. plantarum, Pediococci, Lactococcus etc

**Legumes**

- Lucerne silages more stable than maize (Muck and O’Kiely 1992)
- Legume silages more stable than grass (Dewhurst unpublished observations)

**Additives and silage WSC**

**Chemical Additives**

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**Clamp or bale?**

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<thead>
<tr>
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<th>Clamp</th>
<th>Bale</th>
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</thead>
<tbody>
<tr>
<td>100% Red Clover</td>
<td>356</td>
<td>354</td>
</tr>
<tr>
<td>Dry Matter (g/kg)</td>
<td>3.9</td>
<td>4.0</td>
</tr>
<tr>
<td>pH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ammonia N (g/kg N)</td>
<td>37</td>
<td>42</td>
</tr>
<tr>
<td>Crude Protein (g/kg DM)</td>
<td>205</td>
<td>207</td>
</tr>
<tr>
<td>WSC (g/kg DM)</td>
<td>13</td>
<td>20</td>
</tr>
<tr>
<td>Lactate (g/kg DM)</td>
<td>66</td>
<td>55</td>
</tr>
<tr>
<td>Acetate (g/kg DM)</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>In vivo DMD (%)</td>
<td>60</td>
<td>62</td>
</tr>
</tbody>
</table>

Fychan et al.
Silage analysis
What is involved...?

- Analysing 50 farm silages from Wales
- Comparing Standard NIR analysis with Traditional Wet Chemistry

Silage Analysis

- Silage is analysed by NIR methods
- Technique relies on regression analysis back to wet chemical analysis of a number of samples
- It’s only as good as the subset wet chemistry samples
- Problem is that the subset samples aren’t sufficiently robust for Red Clover

Near Infra Red spectroscopy

![Near Infra Red spectroscopy](image)

Predicted Means and effects of analyses in the study

<table>
<thead>
<tr>
<th>Analysis method</th>
<th>Wet Chemistry</th>
<th>NIR</th>
<th>SED</th>
<th>Effect</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter, g/kg</td>
<td>422.4</td>
<td>412.2</td>
<td>9.11</td>
<td>-10.3</td>
<td>0.265</td>
</tr>
<tr>
<td>pH</td>
<td>5.09</td>
<td>4.61</td>
<td>0.091</td>
<td>-0.48</td>
<td>&lt;0.001</td>
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<tr>
<td>Crude protein, g/kg DM</td>
<td>157.1</td>
<td>134.8</td>
<td>3.75</td>
<td>-22.3</td>
<td>&lt;0.001</td>
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<tr>
<td>Ammonia-N, g/kg DM</td>
<td>8.47</td>
<td>9.69</td>
<td>0.764</td>
<td>1.22</td>
<td>0.116</td>
</tr>
<tr>
<td>Lactic acid, g/kg DM</td>
<td>51.2</td>
<td>66.3</td>
<td>3.90</td>
<td>15.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Neutral detergent fibre, g/kg DM</td>
<td>508.0</td>
<td>521.9</td>
<td>8.96</td>
<td>14.0</td>
<td>0.125</td>
</tr>
</tbody>
</table>

Davies Unpub 2011
Animal Studies with Red Clover Silage

Grass vs. red clover silage: live-weight gain

Take home message

- Red Clover can fix 250kg N/ha per annum so reducing reliance on inorganic N fertiliser
- Red Clover can be ensiled successfully – with wilting and the use of additive being beneficial
- Using Red Clover will improve animal production due to its higher nutritional value and higher intake BUT get it analysed correctly!
About the Silage Advisory Centre (SiLAC)

• We promote independent best practice advice to aid UK and Irish livestock farmers improve silage quality, forage utilisation and thus profitability through research, seminars, knowledge transfer and advisory tools.

• We are an industry initiative supported by founding members: bp/agri, BSH, Dow, Dow Agro, Kuhn, IBERs and Mole Valley Farmers.

• We focus on exploring ways in which baled silage can fit livestock production systems to improve production efficiency, reduce costs and improve profitability.

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