CONSIDERING FORAGE NDF$_{30}$ AS A CONSTRAINT IN DAIRY RATIONS

L. R. Jones$^1$ and J. Siciliano-Jones$^2$

$^1$American Farm Product, Inc.
Ypsilanti, MI

$^2$FARME Institute, Inc.
Homer, NY

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**Why do forages with the same dNDF feed differently?**

<table>
<thead>
<tr>
<th>FIBER</th>
<th>% NDF</th>
<th>% DM</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADF</td>
<td>60.7</td>
<td>22.8</td>
</tr>
<tr>
<td>eNDF</td>
<td>37.5</td>
<td></td>
</tr>
<tr>
<td>NDR (NDF w/o sulfite)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pCNDF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crude Fiber</td>
<td>7.31</td>
<td>2.74</td>
</tr>
<tr>
<td>Lignin</td>
<td>3.23</td>
<td>12.1</td>
</tr>
<tr>
<td>NDF Digestibility (12 hr)</td>
<td>32.3</td>
<td>20.9</td>
</tr>
<tr>
<td>NDF Digestibility (24 hr)</td>
<td>68.8</td>
<td></td>
</tr>
<tr>
<td>NDF Digestibility (30 hr)</td>
<td>60.5</td>
<td>22.7</td>
</tr>
<tr>
<td>NDF Digestibility (48 hr)</td>
<td>69.7</td>
<td>26.1</td>
</tr>
<tr>
<td>NDF Digestibility (240 hr)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**Symposium on Factors Influencing the Voluntary Intake of Herbage by Ruminants: Physiological and Physical Factors Limiting Feed Intake**

H. R. Conrad


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**Dry Matter Intake (DMI)**

**Dry Matter Digestibility (DMD)**

\[ \text{DMD} = \text{NDF} \times \text{NDFD} + 0.98 \times \text{NDS} - 12.9 \]

Forage and Fiber Analysis (Apparatus, reagents, procedures, and some applications).

Goering and Van Soest

1970 USDA Handbook

\[ \text{DMD} = 87.1 - (0.98 - \text{NDFD}) \times \text{NDF} \]

NDF and DMI – Has Anything Changed?

D. R. Mertens

2010 CNC Proceedings

\[ \text{DMD} = 87.1 - \text{NDFu} \]

FARME Institute, Inc

2013
Gut Fill

Simply stated, gut fill is the retention and accumulation of particles in the rumen.

1. Digestion
2. Reduction in physical size
3. Passage Rates

Soy Hulls
67% NDF
87% NDFd
9% NDFu30

What is the impact on Gut Fill?
Gut Fill
• Must take into account Particle Retention Time
• There will not be a single value for all diets!

Effects of particle size of alfalfa hay on retention time and fiber digestibility (Rodrigue & Allen, 1960)

<table>
<thead>
<tr>
<th>Feed</th>
<th>Mean size (μ)</th>
<th>Retention (h)</th>
<th>Fiber digy %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long hay</td>
<td>...</td>
<td>54</td>
<td>44</td>
</tr>
<tr>
<td>Course grind</td>
<td>434</td>
<td>39</td>
<td>34</td>
</tr>
<tr>
<td>Medium grind</td>
<td>393</td>
<td>34</td>
<td>31</td>
</tr>
<tr>
<td>Finely ground</td>
<td>280</td>
<td>27</td>
<td>22</td>
</tr>
</tbody>
</table>

Passage rate is the reciprocal of retention time

NDF\textsubscript{u30} for Gut Fill
• Exclude all feeds with a short retention time (< 4 mm).
• Impact of in vitro NDF\textsubscript{u30} is dependent on overall fiber digestion and passage rate
• Feed type and environment will impact Gut Fill effect.

Measuring the rate of passage of feeds

Dr A T Adesogan
University of Florida
It is not practical to predict DMI simply knowing the load of forage NDF$_{u30}$ being consumed since particle passage rates are influenced by both intrinsic and extrinsic factors (Krämer, 2013).

However, changes in DMI when the load of forage NDF$_{u30}$ is changed can be more predictable (Jones, 2014).

Practical Uses of Forage NDF$_{u30}$

1. Forage changes
2. DMI Evaluation
   - Low DMI, high Forage NDF$_{u30}$
   - Low DMI, low Forage NDF$_{u30}$

Practical Uses of Forage NDF$_{u30}$

1. Forage changes
   - 15% NDF$_{u30}$ 3 pounds NDF$_{u30}$
   - 18% NDF$_{u30}$ 3.6 pounds NDF$_{u30}$

20 pounds of corn silage DM
Practical Uses of Forage NDF$_{u30}$

1. Forage changes
2. DMI Evaluation
   - Low DMI, high Forage NDF$_{u30}$
   - Low DMI, low Forage NDF$_{u30}$
3. Forage evaluation

Evolution

Rumen Fermentable CHO Fill Ratio*
(CVAS Data, 2013 - 2014 Crop Years)

Average 3.41

Corn Silage ONLY RFC-Fill Index

\[
\text{RFC Fill Index} = \frac{(\text{NDF}_{d30} + \text{Starch})}{\text{NDF}_{u30}}
\]
New Tool - Feed Digestibility Analysis

- Service for nutritionists, producers
- Forage & feed ingredient testing for rumen digestibility of starch and fiber
- Includes recommendations to nutritionists in formulating the tested ingredients
- www.calibratetechnologies.com
- Patented

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SilagePro®
American Farm Products

FARME
Institute