General problems of feed analysis

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Problems

- **Unrepresentative** sampling
- Sample deterioration in transit / storage
- Outdated, inaccurate or imprecise methods
- Intra versus inter laboratory variation
- Non-validation of techniques before adoption
- Use of equations validated for one spp. for others.
- Dissemination of results that are biologically unmeaningful / have wrong units
Consequences of wrong results

- Wasted time, money, efforts
- Reduced profitability
- Compromised animal productivity & welfare
- Litigation
Variation in DM methods  (Mertens, 2003)

- NFTA sent nationwide survey on DM methods
- 100 labs responded.
- They used **47** combinations of time and temperature
  - **21** temperatures
    (57 to 140°C)
  - **16** drying times
    (2 to 48 h)

(Czerkawski, 1986)
Variation in composition (%) of corn silage samples analyzed by 9 labs

(Beaner et al., 1996)

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM</td>
<td>27.6</td>
<td>0.86</td>
<td>26 - 29.0</td>
</tr>
<tr>
<td>Total Ash</td>
<td>4.7</td>
<td>2.5</td>
<td>43 - 50</td>
</tr>
<tr>
<td>Starch</td>
<td>22.3</td>
<td>3.6</td>
<td>16.5 – 27.2</td>
</tr>
<tr>
<td>NDF</td>
<td>44.0</td>
<td>2.1</td>
<td>42.9 - 47.8</td>
</tr>
<tr>
<td>CP</td>
<td>10.1</td>
<td>1.8</td>
<td>5.7 – 11.9</td>
</tr>
</tbody>
</table>

Concluded that the variability in CP and starch was too great to be acceptable for use in farming practice.
Reasons for the discrepancies

Analytical error
1. Sampling methods
2. Storage methods
3. Procedures
4. Reagents
5. Calculations
6. Equipment
7. Terms & units

Human error
1. Attention to detail
2. Experience
3. Skill

Random error
1. Attention to detail
2. Experience
3. Skill
Pore sizes most frequently used for in situ rumen degradation trials

<table>
<thead>
<tr>
<th>Pore size (µm)</th>
<th># of citations</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;14</td>
<td>3</td>
</tr>
<tr>
<td>25-29</td>
<td>4</td>
</tr>
<tr>
<td>33-44</td>
<td>8</td>
</tr>
<tr>
<td>50-54</td>
<td>16</td>
</tr>
<tr>
<td>&gt;55</td>
<td>2</td>
</tr>
</tbody>
</table>

(Huntington & Givens, 1995)
Particle sizes most frequently used for in situ rumen degradation trials

(Huntington & Givens, 1995)
Good labs should:

- Labs must monitor precision, reproducibility, repeatability & accuracy
- Validate results with standards / in vivo results
- Enforce stringent quality control
- Regularly calibrate equipment (pipettes, weighing scales etc)
- Ensure health & safety in the workplace
Standardization

- Is standardization idealistic and impossible or is it necessary and achievable.

- If the latter is true, how can it be achieved
  - Ring tests
  - Accreditation scheme
Association of Official Analytical Chemists (AOAC) & Ring Tests

- Sponsors collaborative tests with different labs, materials, personnel, environments & equipment
- Monitors precision, repeatability & reproducibility

- ≥ 5 labs and 3 pairs of analytes should be used (Youden, 1975)

- AOAC requires at least 8 labs & 5 analytes (in duplicate)
Most common, forage analysis versus AOAC approval

<table>
<thead>
<tr>
<th>AOAC-approved</th>
<th>Not-AOAC-approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM</td>
<td>In vitro digestibility methods</td>
</tr>
<tr>
<td>Ash</td>
<td>In situ methods</td>
</tr>
<tr>
<td>CP</td>
<td>Gas production methods</td>
</tr>
<tr>
<td>CF</td>
<td>In vivo digestibility, passage rate etc</td>
</tr>
<tr>
<td>ADF</td>
<td></td>
</tr>
<tr>
<td>NDF</td>
<td></td>
</tr>
</tbody>
</table>
Variability in cell wall fractions measured in ring tests (Mertens, 2003)

<table>
<thead>
<tr>
<th></th>
<th>ADF (AOAC 97.13)</th>
<th>Amylase-NDF</th>
<th>Amylase-NDF (ash-free)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of samples</td>
<td>6</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>No. of labs</td>
<td>10</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>SD repeatability</td>
<td>0.38</td>
<td>1.05</td>
<td>1.00</td>
</tr>
<tr>
<td>SD reproducibility</td>
<td>1.13</td>
<td>1.33</td>
<td>1.24</td>
</tr>
</tbody>
</table>

ADF & NDF data obtained in different studies
Accreditation schemes e.g. National Forage Testing Association (NFTA)

- Certifies the proficiency of participating labs
- Certification based on bias between lab. results & reference values for 6 analytes
- Participation is entirely voluntary
- Only deals with DM, CP, ADF & amylase-NDF
What are the constraints to standardization

- ‘My way is best’ philosophy
- Need to change procedures, equipment, etc
- Who will monitor and ensure adherence
- How can you compel all labs to participate
- What penalties should be imposed on ‘offenders’
- How can the penalties be enforced
- Can accredited labs give misleading results?
References
