Feedstuff NIR analysis in farm to growth herd recording activity

ICAR 2011 Bourg en Bresse, June, 23rd 2011
The feeding process represents a great opportunity of improvement for all dairy farms:
- It is necessary for providing nutrients to animals;
- It is an A cost, actually the most important one!!!

Thousands of Euros can be lost annually through:
• Ingredients inventory shrinkage;
  Improved inventory management: FIFO, new locations, ...
• Inaccurate weighing of components in the ration;
  Accurate & easy to use weighing systems, data tracking ...
• Lack of knowledge of the actual Dry Matter and nutrients.

Now this is the real issue !!!
Forage variability

Variability of alfalfa hay bales

<table>
<thead>
<tr>
<th>constituent</th>
<th>AVG</th>
<th>SD btwn bales</th>
<th>Min - max Btwn bales</th>
<th>SD Wthn bales</th>
</tr>
</thead>
<tbody>
<tr>
<td>NDF</td>
<td>40.2</td>
<td>2.0</td>
<td>36.3 - 44.1</td>
<td>2.1</td>
</tr>
<tr>
<td>CP</td>
<td>17.2</td>
<td>0.8</td>
<td>15.7 - 18.7</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Dr. Collins, 2000
DM % distribution in a CornSilage bunker

Prof. Berzaghi P., Dr. Serva L., 2006
Variation in forages over time

Changes in DM content of Alfalfa haylage – USDFRC Praire du Sac

(modified from Undersander et al., 2005)
Changes in DM Intake relative to baseline

Prof. Mertens and Prof. Berzaghi, 2009
Changes in Milk Yield vs baseline

Prof. Mertens and Prof. Berzaghi, 2009
Forage Variability: we are used to…

Nutritionists know that there is a large nutrient variability in forages and ingredients that are being fed…

... so rations do include a safety margin with the intent of covering at least animal needs even in the worst case!!!

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Forage Variability: an opportunity for...

Forage variability cannot be removed, … but it can be managed thanks to …

• Good sampling protocol;
• Frequent sampling during the time;
• Accurate and fast analysis;
Frequent and Fast analysis are critical for managing variability…

Assuming no sampling or LAB errors
Sampling every 2 wks, results return in 1 wk

Average Error
2.4%

14/7
True value
Frequent and Fast analysis are critical for managing variability…

Assuming no sampling or LAB errors

Sampling every 7 days, results return in 3 days

![Graph showing analysis variability](image-url)

- Average Error: 1.2%

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Frequent and Fast analysis are critical for managing variability…

Assuming no sampling or LAB errors

Sampling every 3 days, results return in 1 day

Average Error

0.7%

%
Over Feeding vs Analysis Costs

- Graph showing the relationship between the number of samples and error over feeding.
- Error over feeding is plotted on the Y-axis, and the number of samples is on the X-axis.
- Cost of analysis is also plotted on the Y-axis, with different lines representing NIRS and chemical lab costs.

Legend:
- NIRS Err.
- Over-Feeding Costs (%)
- NIRS LAB costs
- Chem. LAB Costs
Managing Variability

• Sending samples in for wet chemistry analysis is an opportunity to do retrospective evaluation:
  – Why the fat test dropped
  – Why the milk dropped

• NIR in labs is fast but still not fast enough – what was 10 days is now 2-4 days, but in the meantime a significant amount of the inventory is already done!!!
How can dinamica generale® help out?

AgriNIR™

Trolley material: ABS
ABS provides a rugged and sturdy enclosure for optical and electronic components

Dimensions: 50 x 30 x 46 cm
Weight: 19 Kg

Portable & User Friendly

- Reduced dimensions and weight;
- Car powering connector available;
- Completely inside a trolley;
- Simple User Interface based on Soft keys and intuitive icons;
- Preloaded calibration curves;
- Spectra and Predictions saved on USB key.

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AgriNIR™ Technical Data

**Accuracy**
- Humidity or Moisture: 2%
- Starch: 3%
- Crude Protein: 3%
- ADF: 3%
- NDF: 3%
- Ash: 3%
- Crude Fat: 3%

Working temperature: 0°C / +40°C

Power supply: 110 - 220 Vac
(external power supply included)

9 - 32 Vdc (lighter plug or vehicle battery clips included).
NIR analyzer …for forages on farms

- Spectrometer based on InGaAs detector array;
- Temperature controlled (Peltier controller);
- Spectral Range: 1100-1700 nm;
- Dispersion: < 9,5 nm/pixel;
- Optical Fiber input Ø: 300 μm;
- Tray and scanning chamber special designed for analysing forages;
- Fresh forages, humid and dry, can be sampled and without expensive pre-treatments.
AgriNIR™ Results

MOISTURE (Humidity) value of the sample.

DRY MATTER value of the sample: calculated as 100% - Moisture.

Chemical Parameters on DM

Chemical Parameters on AsIs
AgriNIR™ Results

Printer Header

Customer Code and Company Name

ID of the Analyzed Physical Sample

ID of the Analyzed Component

Name of Analyzed Component

Analysis Results of Nutrients on AsIs and on the Dry Matter

Date and time of the Analysis Execution
## AgriNIR™: Calibration Curves

<table>
<thead>
<tr>
<th>NIR Families</th>
<th>AgriNIR™ accuracy for DG standard calibrations package</th>
<th>NIR Chemical Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Moisture (Humidity)</td>
<td>Starch</td>
</tr>
<tr>
<td>CORN SILAGE</td>
<td>±2,0%</td>
<td>±2,0%</td>
</tr>
<tr>
<td>HAY</td>
<td>±1,0%</td>
<td>n.a.</td>
</tr>
<tr>
<td>HIGH MOISTURE CORN</td>
<td>±2,0%</td>
<td>±3,0%</td>
</tr>
<tr>
<td>ALFALFA HAY</td>
<td>±1,0%</td>
<td>n.a.</td>
</tr>
<tr>
<td>GRASS SILAGE</td>
<td>±2,0%</td>
<td>n.a.</td>
</tr>
<tr>
<td>T.M.R.</td>
<td>±2,0%</td>
<td>±2,0%</td>
</tr>
<tr>
<td>SOYBEAN FLOUR</td>
<td>±1,0%</td>
<td>n.a.</td>
</tr>
</tbody>
</table>
Calibration Curve Update - Process

USB key → Analysis sample data → DG-NIR Manager → NIR Laboratory’s PC with Multivariate analysis software → New calibration curves → USB key

Comp.A37 file with new calibration curves

DG-NIR Manager

DGNM’s elaborated sample data

Multivariate analysis calibration curves
Customer takes care of:

- Sampling;
- Spectra collection with AgriNIR™;
- Chemical analysis at Reference Lab

Dinamica generale / Conseil Elevage takes care of:

- Calibration Curve evaluation;
- Calibration Curve updating;
DG Vision...

On accurate measures a knowledge of the edge...

THANK YOU