Evaluating Alfalfa and Corn Silage
Measuring Particle Size

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University of Illinois Extension
Is this the correct particle size?
Today’s Program

- Forage particle size and rumen function
- Measuring forage particles
- Grain particle size
- Manure particle size
Effective NDF
Chemical NDF
Physically effective fiber

- Providing 5 pounds of feed particles over 0.75 inch
- 550 to 600 minutes of cud-chewing activity per cow per day.
- 60 to 75% of cows at rest should be cud-chewing
- > 60 chews per bolus of feed.
- Rumen pH should be over 5.8
- > 2.2 parts acetate : one part propionate
Chemical NDF

- 28 to 32% of the total ration dry matter

- 1.2% of the cow’s body weight as total NDF (1300 lb cow x 1.2 = 15.6 lb NDF divided by 30% = 52 lb of dry matter)
METHODS TO MEASURE EFFECTIVE FIBER

- Cud chewing per lb of DM (Georgia)
- 19 to 21% forage NDF (Wisconsin)
- Penn State Particle Box (Pennsylvania)
- USDA / Dairyland Lab / Pioneer corn silage starch availability in corn silage (Wisconsin)
- Calculate the amount of effective NDF (IL)
# Penn State Separator

<table>
<thead>
<tr>
<th></th>
<th>Top</th>
<th>2nd</th>
<th>3rd</th>
<th>Bottom</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TMR</strong></td>
<td>10-15</td>
<td>&gt; 40</td>
<td>&lt; 30</td>
<td>&lt; 20</td>
</tr>
<tr>
<td><strong>Haylage</strong></td>
<td>&gt; 40</td>
<td>&gt; 40</td>
<td>&lt; 20</td>
<td>&lt; 5</td>
</tr>
<tr>
<td><strong>Corn silage</strong></td>
<td>5-15</td>
<td>&gt; 50</td>
<td>&lt; 30</td>
<td>&lt; 5</td>
</tr>
</tbody>
</table>

(3/4 TLC-Process)
Applying the Results
Penn State Box

Effective NDF = 100 - (% in bottom box)

Example:
Alfalfa Haylage with 52% in the bottom box
Effective NDF = 100 - 52
= 48% pe NDF-Penn
Applying the Results
Penn State Box

Effective NDF = % in top two boxes

Bagged haylage: 60%
Unprocessed corn silage: 35%
Processed corn silage: 70%
Tub ground hay: 50%
Calculating NDF

- 30lb Hayl DM X 40% NDF = 12.0lb NDF
- 20lb Conc DM X 10% NDF = 2.0lb NDF
- 50lb Total DM = 14.0lb NDF

14.0lb NDF/50lb DM = 28% NDF

Calculating eNDF

- 12.0lb NDF Hayl X 50% = 6.0lb eNDF
- 2.0lb NDF Conc X 10% = 0.2lb eNDF
- 14.0lb NDF = 6.2lb eNDF

6.2lb eNDF/50lb DM = 12.4% eNDF
**Guidelines for peNDF-UI**

- **Hay** 90 to 95%
- **Processed hay (tub ground)** 40 to 65%
- **Haylage** 40 to 80%
- **Corn silage** 30 to 70%
- **By-product feeds**
  - Fuzzy cottonseed 75%
  - Beet pulp, brewers 35%
  - Soy hulls, distillers 5%
- **Grain**
  - Ground corn 5%
  - Cracked corn 30%
  - Pelleted grain 5%
Corn Silage Processing Score

- Sample of corn silage is placed on sieves and shaken for 10 minutes (Ro-Tap Shaker)
- Cost is $16 per sample of corn silage
- Not an on-farm field test at chopping
- After shaking, sub-samples are tested for starch (NIR or wet chemistry) compared to the total starch
  - Coarse (19, 13, 9.5, 6.7, and 4.7 mm)
  - Medium (3.35, 2.36, and 1.18 mm)
  - Fine (0.6 or shorter)
- Guidelines for optimal processing
  - < 30 percent starch on the coarse screen
  - < 25 percent starch on fine screen
Results from 2003-2004
(166 CSPS samples at Dairyland Lab)

- Under processed 47%
  (over 50% starch in top)
- Average processed 44%
  (30 to 50% starch in top)
- Optimal processed 8%
  (under 30% starch in top)
Green Bay Packer Approach

- Put a sample of processed corn silage in a plastic tube with six inches of water
- Float off the plant parts
- Evaluate the corn kernels remaining in the bottom
  - All kernels processed / broken
  - Dry the sample and use grain screens to weigh fractions and determine percentages
If You Are Short of Functional or Physical Fiber

- If the Penn State Box indicates a form problem, add long forage particles.
- If forages are too good, check indigestible NDF levels (40% \textit{indig} NDF x 50 lb dry matter x 30% NDF = 6 lb of \textit{indigestible NDF}) and add a source.
- If you are short of chemical fiber, replace starch with NDF by-products (such as soy hulls, beet pulp, etc).
Using Wheat Straw

- When physically effective NDF is marginal
- When digestible NDF is over 60% for legumes and grass or corn silage is over 70%
- When fecal scores are low and appear related to a lack of effective fiber
- One lb of straw equals three lb hay
- Milk cow rations:
  - Start with one half pound per cow and monitor cow response
  - Maximum of 2 pound per cow
  - Processing to 1 to 2 inches in length
Grain Particle Size
Grain Particle Screens

Number 4  > 4500  Whole/coarse
Number 8  > 2200  Cracked corn
Number 16 > 1100  Ground corn
Number 30 >  500  Pig feed
  Pan     < 500  Powder
# How to Check a Grain Sample for Particle Size

<table>
<thead>
<tr>
<th>Screen Size</th>
<th>Amount (Grams)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td># 4</td>
<td>4g</td>
<td>1%</td>
</tr>
<tr>
<td># 8</td>
<td>74g</td>
<td>20%</td>
</tr>
<tr>
<td>#16</td>
<td>110g</td>
<td>29%</td>
</tr>
<tr>
<td>#30</td>
<td>160g</td>
<td>44%</td>
</tr>
<tr>
<td>Pan</td>
<td>24g</td>
<td>6%</td>
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</table>
## Particle Size Guidelines

<table>
<thead>
<tr>
<th>Screen Size</th>
<th>#4</th>
<th>#8</th>
<th>#16</th>
<th>#30</th>
<th>Pan</th>
</tr>
</thead>
<tbody>
<tr>
<td>H.M. Corn (&gt;30%)</td>
<td>75</td>
<td>25</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>H.M. Corn (25-30)</td>
<td>25</td>
<td>50</td>
<td>25</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>H.M. Corn (&lt;25%)</td>
<td>0</td>
<td>&lt;10</td>
<td>30</td>
<td>50</td>
<td>&lt;20</td>
</tr>
<tr>
<td>Dry corn</td>
<td>0</td>
<td>&lt;10</td>
<td>30</td>
<td>50</td>
<td>&lt;20</td>
</tr>
<tr>
<td>Sample Shakeout</td>
<td>1</td>
<td>20</td>
<td>29</td>
<td>44</td>
<td>6</td>
</tr>
<tr>
<td>Type</td>
<td>Mcal/lb DM</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>---------------------------</td>
<td>------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cracked</td>
<td>0.84</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Ground</td>
<td>0.89</td>
<td></td>
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<tr>
<td>High moisture</td>
<td>0.93</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Steam flaked</td>
<td>0.93</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High lysine</td>
<td>0.94</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Finely ground</td>
<td>0.96</td>
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</table>
### Dairy NRC 2001

**Processing adjustment factor (PAF)**

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Factor</th>
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<tbody>
<tr>
<td>Steam flaked corn</td>
<td>1.04</td>
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<tr>
<td>H.M. corn</td>
<td>1.04</td>
</tr>
<tr>
<td>Bakery waste</td>
<td>1.04</td>
</tr>
<tr>
<td><strong>Ground corn</strong></td>
<td><strong>1.00</strong></td>
</tr>
<tr>
<td>Cracked corn</td>
<td>0.95</td>
</tr>
<tr>
<td>Corn silage, normal</td>
<td>0.94</td>
</tr>
<tr>
<td>Corn silage, mature</td>
<td>0.87</td>
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</table>
Manure
Particle Size
MANURE MANAGEMENT

- Consistency
- Changes
- Screening
WASHING MANURE

- Use a number 6 or 8 screen
- Evaluate a cup of manure
- Use pressurized water
- Cows to evaluate
  - dry cows
  - fresh cows
  - high cows
  - high producing 1st lact cows
  - various groups of cows
MANURE SCREENING

- Rumen
  - Passage of split soybeans
  - Presence of whole cottonseed
- Processing
  - Appearance whole soybeans
  - Presence of whole corn seed
  - Presence of forage particles over 1/2”
- Combination of rumen and processing
  - Appearance of starch in corn seed
Where to Order

- Penn State Box -- NASCO, Fort Atkinson, Wisconsin ($300 with scale)

- Screens--Seedbоро Equipment Co
  312-738-3700 (Chicago, IL) Five screens about $50 per screen
Questions?