Making High Quality Alfalfa
Primary objectives

- Yield
- Quality
- Persistence
Harvesting Forages for High Feed Quality
The 3 Factors That Most Affect Forage Quality Are:
Maturity
Changes in Quality as Alfalfa Matures

Fig. 2

% of Dry Wt.

Stage of Maturity

- CP
- ADF
- NDF
- DDM
Timely harvest

- The largest single effect on forage quality is date of harvest.

Daily Rate of Forage Quality Change in Spring

<table>
<thead>
<tr>
<th>Component</th>
<th>2006 - 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude Protein</td>
<td>-0.25</td>
</tr>
<tr>
<td>Neutral Detergent Fiber</td>
<td>0.43</td>
</tr>
<tr>
<td>NDFD</td>
<td>-0.43</td>
</tr>
<tr>
<td>RFV</td>
<td>-2.9</td>
</tr>
<tr>
<td>RFQ</td>
<td>-3.6</td>
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Alfalfa Maturity Affects Milk Production

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<tr>
<th>% Concentrate</th>
<th>Alfalfa maturity (bloom)</th>
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<td>Pre</td>
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Extra concentrate **CANNOT** fully replace the loss in feed value (or milk production) when alfalfa quality declines.
The 3 Factors That Most Affect Forage Quality Are:
Maturity
Harvest Losses

Storage Losses
# Mechanical losses

<table>
<thead>
<tr>
<th>Operation</th>
<th>% of nutrients lost</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>Range</td>
</tr>
<tr>
<td>Mowing</td>
<td>2</td>
<td>1 - 4</td>
</tr>
<tr>
<td>Conditioning</td>
<td>5</td>
<td>2 - 10</td>
</tr>
<tr>
<td>Raking</td>
<td>8</td>
<td>3 - 20</td>
</tr>
<tr>
<td>Tedding</td>
<td>7</td>
<td>3 - 25</td>
</tr>
<tr>
<td>Baling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>square</td>
<td>7</td>
<td>3 - 8</td>
</tr>
<tr>
<td>round</td>
<td>9</td>
<td>4 - 18</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>12 - 50</td>
</tr>
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</table>
Leaf Structure

Legumes have 10 times more stomata than grasses.

Upper and lower epidermis is heavily coated with wax

- conserves water
- protects surface cells

Stomatal openings

Upper and lower epidermis

Palisade chlorophyll

Spongy mesophyll

Stoma

O$_2$, water vapor

CO$_2$

Water

Photo-synthetic products

Vein
Sequence of Drying Forages

Moisture

80%
60%
20%

Stomatal openings
Conditioning
Weather regulated
Osmotic & Cell forces

Time
Conditioner types

Flail/impellers

Rubber intermeshing Rolls
Leaf loss of different conditioner types

Source: Koegel et al., 1985

Leaves removed from stems by impeller

<table>
<thead>
<tr>
<th>Conditioner Type</th>
<th>Loss, %</th>
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<tr>
<td>Sickle Roll</td>
<td>3.95</td>
</tr>
<tr>
<td>Rotary Roll</td>
<td>4.7</td>
</tr>
<tr>
<td>Rotary Impeller</td>
<td>6.43</td>
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Alfalfa losses due to moisture content when raked

![Graph showing Alfalfa losses due to moisture content when raked. The graph illustrates the relationship between percent moisture of hay and percent loss, with two lines representing dry matter loss and leaf loss.]
Equilibrium moisture concentrations of alfalfa hay at different humidities.
Preservatives

* Inhibit or kill bacteria, mold, and yeast

* Discoloration

* Reduce but will not eliminate heat damage
Bale Wrapping
Why Choose Baled Silage over Hay?

- well-made baled silage will often exhibit better quality characteristics than corresponding hays
  - less leaf loss (legumes)
  - less wilting time required
  - reduced risk/exposure to rain damage
  - little or no spontaneous heating
  - no weathering after baling (outdoor storage)
Moisture Management for Baled Silage

Generally, baled silage should be packaged at 45 to 55% moisture (Shinners, 2003); the average for the whole field or group of bales should be about 50%.

- production of silage fermentation acids is positively associated with moisture concentration
- moisture recommendations for chopped silages are < 70%
- as a result, baled silage fermentation is inherently restricted, resulting in a slower fermentation, and a greater (less-acidic) final pH
Inoculants

- high buffering capacity
- low fermentable carbohydrate
- developed for haylage
- add at chopper or baler
Effect of Plastic Wrap Thickness on Internal Bale Temperature over Time, 30% moisture
Effect of Timing of Bale Wrapping after Baling on Internal Bale Temperature over Time, 36% moisture

![Graph showing the effect of timing of bale wrapping on internal bale temperature over time. The y-axis represents temperature in degrees Fahrenheit (F), and the x-axis represents time in days from the start of the experiment. Different lines represent different timing of wrapping: 0 hours, 24 hours, 48 hours, and 96 hours. The graph illustrates how wrapping timing affects the temperature decrease over time, with earlier wrapping leading to a more rapid cooling.](image-url)
TDN loss as result of heating damage
Tube vs. Individual Wrapping

- **Advantages – Tubes**
  - Less plastic used
  - Greater productivity
  - Less labor

- **Advantages – Individual**
  - Targeted feeding
  - Marketable product
  - Occupies less area
  - Less aerobic loss @ feedout
Baleage vs. Chopped Silage

- Advantages Baled Silage
  - Less expensive equipment
  - Wider moisture range
  - Targeted feeding
  - No taxable structure
  - Ideal for small operator

- Advantages Chopped Silage
  - Better fermentation
  - More versatile
  - High capacity
  - Easier TMR mixing
  - Less sorting
Chop length: $\frac{3}{4}$ to 1 inch
Pack Silage Well
STORING BIG BALES

* Cure before storing
* Air circulation
* Humidity and temperature
* Weather damaged
* Drying fans
Thank you
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