“Hay Day” Management
Nuts & Bolts of Making Hay and Silage

Tim Schnakenberg,
Regional Agronomy Specialist, Galena, MO

Thanks to Rob Kallenbach, Forage Specialist, for many of the slides used in this presentation.
Typical Forage Harvesting Losses

Field curing -26%
Harvesting -14%
Storage -35%
Feeding -30%

30% Left
Optimum Management

Field curing -12%

Harvesting -8%

Storage -5%

Feeding -8%

70% Left
Key Factors

- Quality at time of harvest
- Harvest and preservation techniques
- Storage methods
Moisture Content Affects Harvest & Storage Losses

Source: Hoglund (1964)
Hay and Silage Making Losses

- Mechanical handling losses
- Leaching losses
- Respiration losses
Mechanical Handling Losses

- Mowing
- Tedding
- Raking
- Baling or Chopping
- Handling
# Mowing & Conditioning Losses

<table>
<thead>
<tr>
<th>Type of Mower</th>
<th>% D.M. Lost</th>
<th>% Leaves Lost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sicklebar mower only</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Sicklebar mower, fluted rolls</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Disc mower only</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Disc mower, fluted rolls</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
# Raking & Tedding Losses

<table>
<thead>
<tr>
<th>Moisture Content</th>
<th>Raking</th>
<th>Tedding</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% D.M. Lost</td>
<td>% Leaves Lost</td>
</tr>
<tr>
<td>70%</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>60%</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>50%</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>33%</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>20%</td>
<td>12</td>
<td>21</td>
</tr>
</tbody>
</table>
## Baling Losses

<table>
<thead>
<tr>
<th>Moisture Content</th>
<th>Pickup + Chamber</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% D.M. Lost</td>
</tr>
<tr>
<td>25 % (with preservative)</td>
<td>1</td>
</tr>
<tr>
<td>20 %</td>
<td>2</td>
</tr>
<tr>
<td>12 %</td>
<td>3</td>
</tr>
</tbody>
</table>

% Leaves Lost

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>25 % (with preservative)</td>
<td>2</td>
</tr>
<tr>
<td>20 %</td>
<td>3</td>
</tr>
<tr>
<td>12 %</td>
<td>4</td>
</tr>
</tbody>
</table>
Effect of Moisture on Heat Retention in Big Bales

The graph shows the temperature in °F over days for different moisture levels: 18%, 22%, and 35%. The temperature increases rapidly at the beginning and then decreases gradually.
Maximum Moisture Content at Baling

- Small Square: 22%
- Large Round: 18%
- Large Square: 16%
Shape Dictates Moisture Content at Baling

Small Square Bale

60 lbs. ÷ 21.3 sq.ft. = 2.8 lbs./sq.ft.

Large Round Bale

1200 lbs. ÷ 122.5 sq.ft. = 9.8 lbs./sq.ft.
Leaching Losses

- Can remove 40% of the nutrients in a single event
- Dramatically reduces the marketability of hay
- Minimizing drying time is the key
Sickle vs. Disc

- Clean cut
- Slower
- Low Horsepower

- Close cut
- Quicker
- Higher Horsepower
- Cumbersome to mount
Use wide swaths

- Maximizes solar drying capacity
- Can reduce drying time by 50%
- Gives hay a more even color
Mechanically Condition Hay

- Stems and leaves dry at nearly the same rate
- Breaks cuticle or waxy layer
- Can reduce drying time 30-50%
**Flail (Impeller) Mowers**

Faster drying the first day - breaks vascular tissue

Works best for thin-stemmed grasses over thick stem and leafy forages

*Figure 2: The two conditioner styles: impeller or flail-type (left) and roller-crimper (right).*

Photo: Dennis Hancock, Univ. of Georgia
Use a Tedder EARLY in the Process

- Use the morning after cutting
- Be sure hay is not too dry before finishing
- Can reduce drying time 20 to 30%
Practical Ways Producers Can Speed Haymaking

- Use weather forecasting to minimize exposure to rain
- Dry hay in wide swaths as opposed to narrow windrows
- Mechanically condition hay
- Ted hay in the morning ~ 65% moisture
- Use a preservative
- Make silage or baleage instead of hay
Minimize Ash Content When Harvesting Forages

- Internal and External Ash
- External - Dirt and Dust
- Normal Internal = 8% Legumes = 6% Grasses
- Typical internal amounts found = 9–18%
  - 18% ash means 1 lb of “dirt” is fed out of each 5 lbs of hay or silage fed!
Tips to Minimize Ash Content

1. Use flat knives on disc mowers
2. Raise the cutter bar of a disc mower
3. Avoid harvesting lodged forage
4. Keep the windrow off the ground
5. Keep rake tines from ground contact
6. Windrow mergers keep hay from being moved laterally
7. Store hay off the ground
8. Store silage piles on concrete
Silage

- Low harvest losses
- Totally mechanized handling
- Less dependant on weather
- but....
- High capital investment
- Less marketable than hay
Big Balage

Lower initial cost than a conventional silage system

Lower harvest losses than hay

Easier to market than conventional silage

Flexible harvest options
Key Factors

- **Quality at time of harvest**
  - Balage only preserves and does not really enhance forage quality
- **Suitability of forage for ensiling**
- **Harvest and preservation techniques**
- **Storage methods**
Making Good Silage

Wilt forage to 50 to 60% moisture
Pack material tightly (Chop 3/8 to 1/2 in.)
Ensile as quickly as possible
- Fast fermentation leads to a more stable feed and more nutrient retention

• KEEP THE OXYGEN OUT!
What Happens in the Silo

Phase 1
Cell Respiration
Production of CO₂
Production of Heat

Phase 2
Production of Lactic Acid

Phase 3
Lactic Acid Formation Begins

Phase 4
Lactic Acid Formation

Phase 5
Depends upon Phase 4
If enough lactic acid was formed, the silage remains constant

If insufficient acid was formed, butyric acid production begins

Protein may be broken down and spoilage may be excessive

Temperature Change
69°F to 90°F

pH Change

Acetic Acid Bacteria

Lactic Acid Bacteria

Relative Rate of Seepage Loss

Age of Silage (days)
Making Good Balage

Wilt forage to 50 to 60% moisture – upper end for grasses – lower end for legumes

Make bales as dense as possible
- Longer fiber slows fermentation

Wrap as quickly as possible
- Within 5 hours of baling

• KEEP THE OXYGEN OUT!
Crude Protein of Alfalfa Balage

<table>
<thead>
<tr>
<th>Moisture Content at Baling (%)</th>
<th>Pre-Storage</th>
<th>Post-Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>54</td>
<td>23</td>
<td>22</td>
</tr>
<tr>
<td>49</td>
<td>22</td>
<td>21</td>
</tr>
<tr>
<td>43</td>
<td>21</td>
<td>20</td>
</tr>
<tr>
<td>22</td>
<td>19</td>
<td>18</td>
</tr>
</tbody>
</table>
It’s all about moisture content at harvest and how fast it is put in an anaerobic environment for fermentation to begin.
Digestibility of Alfalfa Balage

Digestibility (%)

V_DMD

Hay

55

60

65

70

Moisture Content at Baling (%)

54%

49%

43%

22%

54% 49% 43% 22%
## Red Clover Balage

<table>
<thead>
<tr>
<th>Treatment</th>
<th>CP</th>
<th>NDF</th>
</tr>
</thead>
<tbody>
<tr>
<td>RC balage</td>
<td>21.1</td>
<td>35.7</td>
</tr>
<tr>
<td>RC hay</td>
<td>16.3</td>
<td>49.8</td>
</tr>
</tbody>
</table>

(60% moisture at baling)
## Ryegrass Balage Comparison to Hay

<table>
<thead>
<tr>
<th>Treatment</th>
<th>CP %</th>
<th>TDN %</th>
<th>RFQ</th>
<th>ADG lbs/hd/ d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ryegrass Hay</td>
<td>14.7 b</td>
<td>62.4 c</td>
<td>133 b</td>
<td>1.26 b</td>
</tr>
<tr>
<td>Ryegrass Balage</td>
<td>16.3 a</td>
<td>65.9 a</td>
<td>174 a</td>
<td>1.94 a</td>
</tr>
<tr>
<td>Bermuda Hay</td>
<td>16.1 a</td>
<td>62.9 b</td>
<td>116 c</td>
<td>1.56 b</td>
</tr>
</tbody>
</table>

Replacement Heifers Gain – No additional supplementation
Ryegrass hay received a light rain shower on it
Unpublished data, Calhoun, GA, 2009, Dennis Hancock

$P<0.10$
Several types of wrappers are available
Platform Wrappers

Features:
- Trailer or 3-point hitch
- Round or square bales
- Tractor hydraulics or gas engine
- Plastic $3.50 - $4.50/bale for 4 layers
- Some have a loader arm – most can be loaded with a front-end loader
Platform Wrappers

Concerns:
Plastic cost
Labor per bale
Most only accommodate four ft. wide bales
Square Bale Platform Wrappers
Other Wrappers

End-to-End
Individual Wrap

Concerns:
Labor
Plastic on bottoms of bales
Balage - Transport

- Avoid handling if possible
- If bales must be moved, use a grapple to avoid puncturing plastic
In-Line Wrappers

Features:
- Bales end-to-end
- Less labor for wrapping
- Lower plastic cost (1/2 or less)
In-Line Wrappers

Concerns:
Uniformity of adjacent bales (both size and density)
End of rows need to be sealed by hand
A hole in the plastic can spoil a large area
Feedout rate (need to feed two or three per day to keep ahead of spoilage)
Balage - Wrapping

- Wrap with at least four layers of 1-mil plastic with 50% overlap. 8 mil total is ideal for long-term storage
- Use high-quality plastic
Alfalfa Silage & Hay

Alfalfa silage & hay from the same field
2, 4, or 6 layers of stretch film - platform wrapper

<table>
<thead>
<tr>
<th>Storage Treatment</th>
<th>Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 layers</td>
<td>53%</td>
</tr>
<tr>
<td>4 layers</td>
<td>84%</td>
</tr>
<tr>
<td>6 layers</td>
<td>88%</td>
</tr>
<tr>
<td>Hay</td>
<td>64%</td>
</tr>
</tbody>
</table>
Balage - Storage

Store in a well drained site
Store bales where animals won't damage them
Weeds encourage rodents
Storing on the flat side prevents squatting
Patch holes promptly
Crops to Wrap

Legumes
    Alfalfa
    Red clover
    Soybean

Cool Season Grasses
    Tall fescue
    Wheat / Triticale / Rye
    Annual Ryegrass

Warm Season Grasses
    Forage sorghum
    Sudangrass
    Pearl millet
    Immature corn

Legume-Grass mixes work best
Grasses vs. Legumes

- Grasses tend to ferment better than do legumes – more water-soluble carbohydrates
- pH near 4 for all grass treatments
- Much more acid production than in alfalfa silage
When to Wrap

Wrap as soon as possible after baling

Definitely on the same day – Start a little on the wet side

Delayed wrapping prevented adequate fermentation as reflected in the higher pH value

Suggestions:
Hot, summer day – 2 hrs
Cool, fall day – 8 hrs
(Depends on weather and type of forage)
Other tips

Do not use treated sisal twine. The treatment breaks down the plastic.

Inoculants are a good option if the moisture isn’t right – Speeds up lactic acid formation.

Don’t wrap in the rain.

Bales should be fed within one year of wrapping.

Wrapping area and storage areas should be close.