What’s New in Forage Machinery hay

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Harvesting Forage

- Wide swath
- Conditioning
- Reconditioning
- Tedding, Raking, Merging
- Baling
Wide swath benefits

- Faster drying
- Higher forage quality
Respiration continues after cutting until plants dries below 60% water.

Breakdown of starch and sugars

2 – 8% of Dry Matter loss
Sequence of Drying Forages

- Stomatal openings
- Conditioning
- Weather regulated Osmotic & Cell force

Moisture Levels:
- 80%
- 70%
- 20%

Time
Leaf Structure

Legumes have 10 times more stomata than grasses

Upper and lower epidermis is heavily coated with waxy cutin, conserves water and protects

Stomatal openings
Keeping Stomata Open

- Sunlight – necessary to keep stomata open
- Shading closes Stomata
- 20 – 30% of water removed before stomata close
Put hay into wide swath
Keep off of ground
Relative humidity inside windrow
Effect of wide swath on drying rate

Figure 2a. Field 506 N Arlington Research Station
May 29, 30, 31, 2007
wide swath vs narrow swath drying rate
Effect of wide swath on drying rate

Figure 2b Field 506 N Arlington Research Station
July 30, 31, Aug 1 2007
wide swath vs narrow swath drying rate

- 9am Day 1
- 2pm Day 1
- 5pm Day 1
- 9am Day 2
- 2pm Day 2
- 5pm Day 2
- 9am Day 3
- 2pm Day 3
- 5pm Day 3

wide swath
narrow swath
**Effect of wide swath on alfalfa composition at harvest**

<table>
<thead>
<tr>
<th>Componen</th>
<th>Average Difference</th>
<th>Number of trials</th>
<th>Minimum Difference</th>
<th>Maximum Difference</th>
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<tbody>
<tr>
<td>CP</td>
<td>0.15</td>
<td>14</td>
<td>-1.16</td>
<td>1.75</td>
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<tr>
<td>NDF</td>
<td>-0.9</td>
<td>14</td>
<td>-4.3</td>
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<td>NFC</td>
<td>0.49</td>
<td>14</td>
<td>-4.03</td>
<td>3.07</td>
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<tr>
<td>Ash</td>
<td>0.47</td>
<td>14</td>
<td>-0.8</td>
<td>3</td>
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</table>

Note: beneficial differences observed in 10 of 14 trials
Maximum swath width versus cutting width
Mowing without conditioning for Silage

- Less expensive
- Less energy to operate
- Faster mowing
Why should ash content be a concern?

- Ash provides minerals to the diet, but no calories (i.e. energy).
- Takes the place of nutrients on almost a 1:1 basis.
- Ash content above that contained in plant is dirt contamination.
What about research looking directly at the effect of % ash in the forage in milk production?

“While there have been few dairy research trials in this area, it is highly likely that cows do not milk well when fed dirt.”

Pat Hoffman, Dairy Scientist, Marshfield ARS, 2002
Possible Causes of Higher Levels of Ash in Forages

Mower knife type

Those knives that “pick up hay” better, also pick up more ash.
Possible Causes of Higher Levels of Ash in Forages

Disk Cutterbar Cutting height
Possible Causes of Higher Levels of Ash in Forages

- Disc mower knives angled
- Forage cut too close to ground
- Windrow falls on ground
- Raking
Conditioning to break stems
Conditioner types

- Flail/impellers
- Rubber Rolls
Roll and Impeller Comparison

- Roll creates a crushing action
- Impeller creates a stripping action
- Impeller tends to have higher leaf losses
Mowing and conditioning

- Mow without conditioning for silage with wide swath
- Mow with conditioning for hay or silage in windrow
  - Buy with conditioner to make swath at least 70% of cut area.
  - Use flail conditioner for grasses.
  - Use roller conditioner for alfalfa.
Superconditioner

completely crushes alfalfa stems without stripping off leaves.
Superconditioner

completely crushes alfalfa stems without stripping off leaves.
Macerator

- A first rotating crushing roller coupled with a second rotatable crushing roller
Macerator

1. Feed cut forage into the rubber rolls
2. Then into a set of steel, serrated rolls which macerate.
3. Aggressiveness of the maceration is determined by the air pressure settings on the
Raking, tedding, merging
Tedders

- To spread swath or windrow for faster drying
Tedder - fluffer
Inverter

- Inverts or turns windrows over
Wheel Rakes
### Ash Content of Forage Samples

<table>
<thead>
<tr>
<th>Type</th>
<th>Statistic</th>
<th>% Ash</th>
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<tr>
<td>Haylage</td>
<td>Avg</td>
<td>12.3</td>
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<tr>
<td></td>
<td>Max</td>
<td>18.0</td>
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<tr>
<td></td>
<td>Min</td>
<td>5.7</td>
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<tr>
<td>Hay</td>
<td>Average</td>
<td>10.3</td>
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<tr>
<td></td>
<td>Max</td>
<td>17.6</td>
</tr>
<tr>
<td></td>
<td>Min</td>
<td>8.8</td>
</tr>
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Wheel Rake

- Least Expensive
- High ash potential
  - Adjust wheel float to minimum needed to pick up hay.
Parallel Bar Rake

- Powered
- High maintenance
- Rigid across uneven ground
Rotary Rakes

- Powered
- High maintenance
- Can ted/rake/merge windrows
- Most expensive
Windrow Merger

- Picks up hay to move across ground
- Expensive
Economics of Merging

[Graph showing cost comparison for different windrow settings with categories Chop, Merge, and Mow]
Baling

- Cutting forage for hay/haylage - bales that break apart easily for feeding
  - Higher initial cost
  - Higher energy requirement
  - Stones

  ✔ Better feed intake
  ✔ Better animal gain
  ✔ Less feeding loss
Electronic Monitoring Systems

- **The electronic control system**
  - Automatically maintains bale density by adjusting hydraulic pressure on the top and sides of the bale as crop and moisture conditions change.
  - Registers the movement of each individual twine to provide you with earliest possible warning of a mistie.
Hay Preservative Application System

- Senses moisture on-the-go
- Adjusts the application of preservative every three seconds to match the condition of the hay.
- Adjusts for dew and hay drying.

Harvest Tec
Hay Preservative Application System

Automatic systems for round balers are equipped with two sensing discs, one mounted on each of the baler's side walls, sensing from side to side.

HayBoss™ systems for large square balers are equipped with star wheel sensors that run through the bale picking up moisture and speed of baling.
Dew Simulator

- Used in arid regions where need softening effect of dew
- Lengthen baling time
- Water delivered by tines on a cam
  - When tine in hay water sprayed at 2500psi
Constant bale flake size

- Crop is compressed in a crescent-shaped feeding chamber.
  - When the flake of material reaches the density level that you set, sensor paddles are tripped and the stuffer forks deliver the flake into the bale chamber.
  - Each hay charge is the same size, density and weight, creating uniform bales with an equal number of flakes.

Case IH
Tight round bale centers

- Hay entering the forming chamber from the pickup, immediately formed to a tight, dense core.
- Incoming hay then feeds between the bale and the lower-gate roll and is tightly compressed into smooth, dense layers as it enters the bale.
- Full-size bale in bale chamberIdler arm rises with bale growth, forcing oil from the hydraulic cylinder through a pressure-relief valve.
Summary

- Begin with wide swath
- Conditioning necessary for hay not haylage
- Reconditioning only for grass
- Tedding for grasses
- Raking, merging for grasses and legume
- New technology improves baling
Bigger Equipment

- Up to 31 ft 9.9 in
- 32 feet
- Up to 30 feet
- 1020 hp max. output