**Alfalfa Management – Don’t Stand Still or You’ll Get Mowed Over**

Dr. Dan Undersander
University of Wisconsin

- Variety selection
- Alfalfa/grass mixtures
- Mowing/conditioning
- Silage making

**Alfalfa Yield and Dollar Return from Wisconsin Green-Gold Program**

Economic return increases with yield:
- Fixed inputs remain constant
- Variable inputs increase only slightly with yield.

**Forage acreage needed to produce feed for 500 cow herd with 75 dry cows**

Assumes:
- 500 milking (1300 lb) cows
- 75 dry (1500 lb) cows
- Alfalfa 50% of forage
- 2.1% body wt intake

(From Blonde spreadsheet)

**Yield difference between top and bottom alfalfa entries in Wisconsin Alfalfa Trials, 1985 to 2012**

Average Yield Difference: 2.24 t/a DM
Economic Value: $560/a

**Selecting Alfalfa Varieties**

- Yield
- Persistence

Value of short rotations:
- Older stands yield less
- Increased weed problems in old stands
- Nitrogen credits when alfalfa is plowed down
- Rotational benefit to corn
  - 10 to 15% greater corn yield
  - Reduced root worm on corn following alfalfa
Selecting Alfalfa Varieties

- Yield
- Persistence
- Disease Resistance

Effect of Verticillium Resistance on Alfalfa Persistence

Winter Survival and Winter Injury

*What can you do?*

- Plant very winterhardy varieties
- Maintain soil fertility and pH
- Let one harvest go to early flower
- Avoid fall cutting
- Mix alfalfa and grass

Lack of alfalfa winterhardiness results in:

- Winterkill
- Yield loss
- Uneven spring greenup

Crop Injury Loss of Alfalfa herbicides

- In 13 trials in MN and WI average yield loss from Raptor or Pursuit was 0.25 t/a for next cutting
Development of New Varieties

- Roundup Ready Alfalfa – Another tool in the box
  - Beneficial if:
    - Multiple herbicide applications
    - Unusual weed problems
    - Less alfalfa crop injury than other herbicides
    - Ease of use
  - Not beneficial if:
    - Establish with cover crop
    - Alfalfa/grass mixtures

Why incorporate some grass into dairy rations?

Agronomic
- Improve yields of seeding year stands
- Faster drying
- Less risk of winterkill
- Manure management

Nutrition
- Higher total fiber with grass/legume mixtures than alfalfa
- Higher proportion of digestible fiber than alfalfa or CS
- Possible good fit with high NFC, low fiber diets (i.e. high corn silage diets)?

Typical composition of high quality grass forages

<table>
<thead>
<tr>
<th>Forage</th>
<th>CP</th>
<th>NDF</th>
<th>NDFD</th>
<th>NFC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reed Canarygrass</td>
<td>20</td>
<td>55</td>
<td>68</td>
<td>12.5</td>
</tr>
<tr>
<td>Perennial Ryegrass</td>
<td>18</td>
<td>47</td>
<td>65</td>
<td>22.5</td>
</tr>
<tr>
<td>Tall Fescue</td>
<td>17</td>
<td>56</td>
<td>60</td>
<td>14.5</td>
</tr>
<tr>
<td>Annual Rye</td>
<td>20</td>
<td>55</td>
<td>60</td>
<td>12.5</td>
</tr>
<tr>
<td>Orchardgrass</td>
<td>16</td>
<td>60</td>
<td>55</td>
<td>11.5</td>
</tr>
<tr>
<td>Alfalfa</td>
<td>20</td>
<td>40</td>
<td>48</td>
<td>27.5</td>
</tr>
<tr>
<td>Corn Silage</td>
<td>9</td>
<td>41</td>
<td>68</td>
<td>37.5</td>
</tr>
</tbody>
</table>

Lameness in Dairy Cattle

Midwest United States:
Overall 20-25% of cows are mildly to seriously lame.
Causes: 58% due to disease or trauma,
42% due to nutrition (excessive grain/inadequate fiber)
Severely influenced by diet, stall design and bedding, stocking density, time in parlor holding area, etc.
Potential Milk Losses Due to Lameness

<table>
<thead>
<tr>
<th>Locomotion Score</th>
<th>2 (Mild)</th>
<th>3 (Moderate)</th>
<th>4 (Severe)</th>
<th>5 (Severe)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM intake reduction, lb</td>
<td>1</td>
<td>3</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>Milk Yield Loss, lb</td>
<td>0</td>
<td>5</td>
<td>15</td>
<td>30</td>
</tr>
</tbody>
</table>

Adapted from P. Robinson, UC-Davis Cooperative Extension

Select Grass Varieties for

- Yield
- Winterhardiness
- Late maturing varieties
- Consistent yield throughout season (β)
- Rust resistance
  - orchardgrass,
  - tall fescue,
  - ryegrass,
  - festolium

Select Grass Varieties - Yield difference among varieties in UW Trials

<table>
<thead>
<tr>
<th>Variety</th>
<th>Annual difference between top and bottom variety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parent</td>
<td>6</td>
</tr>
<tr>
<td>Festolium</td>
<td>4</td>
</tr>
<tr>
<td>Orchardgrass</td>
<td>2</td>
</tr>
<tr>
<td>Tall fescue</td>
<td>0</td>
</tr>
<tr>
<td>Scots fescue</td>
<td>-2</td>
</tr>
<tr>
<td>Timothy</td>
<td>-4</td>
</tr>
</tbody>
</table>

Selecting Grasses

- Want winterhardy types

Selecting Grasses

- Orchardgrass and tall fescue
- Want late maturing types

Seasonal variation in Tall Fescue variety yield

- low β
- average β
- high β
Select Grass Varieties for

- Yield
- Winterhardiness
- Late maturing varieties
- Consistent yield throughout season (β)

**Economic Value of premium grass varieties**

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost/unit</th>
<th>Cost/value per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional cost</td>
<td>$1.00/lb</td>
<td>$6.00/a</td>
</tr>
<tr>
<td>Additional yield</td>
<td>2 t/a @ $100/t</td>
<td>$200/a</td>
</tr>
</tbody>
</table>

Yield of alfalfa/grass mixtures

### Alfalfa grass mixes

- Alfalfa - orchardgrass
  - 10 lbs/a alfalfa; 4 lb/a orchardgrass
  - 47 alfalfa
  - 18 orchardgrass
  - 87 seeds/sq ft

- Alfalfa - tall fescue
  - 10 lbs/a alfalfa; 6 lbs/a tall fescue
  - 47 alfalfa
  - 23 tall fescue
  - 70 seeds/sq ft

- Alfalfa - meadow fescue
  - 10 lbs/a alfalfa; 6 lbs/a meadow Fescue
  - 47 alfalfa
  - 27 meadow fescue
  - 74 seeds/sq ft

**Harvesting High Quality Forage**

- Start harvesting when forage at desired quality

**Rate of Alfalfa Forage Quality Change per Day**

<table>
<thead>
<tr>
<th>Component</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude Protein, % DM</td>
<td>-0.25</td>
</tr>
<tr>
<td>Acid Detergent Fiber, % DM</td>
<td>0.36</td>
</tr>
<tr>
<td>Neutral Detergent Fiber, % DM</td>
<td>0.43</td>
</tr>
<tr>
<td>Neutral Detergent Fiber Digestibility, % NDF</td>
<td>-0.43</td>
</tr>
<tr>
<td>RFQ, points</td>
<td>-3.6</td>
</tr>
</tbody>
</table>

With RFQ valued at $1.50/pt, economic value = $5.40/t/day

Source: Undersander, 2009 unpublished
Forage Quality Stick

Measure from soil surface.
Measure to top of stem tip, not tip of highest leaflet.

Estimates are made at 4 to 5 locations in a field.
The tallest stem may not be the most advanced in maturity.

Harvest First Cutting by Height

Headline Fungicide on Alfalfa

Treatment cost of $35/A including the application fee ($8/A).

Is it economic?

Effect of Headliner on Alfalfa Yield, 2012

Harvesting High Quality Forage

- Start harvesting when forage at desired quality
- Mow, condition, put in wide swath
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 forces

Leaf Structure

- Legumes have 10 times more stomata than grasses
- Upper and lower epidermis is heavily coated with waxy cutin, conserves water and protects

Summary

- Wide Swath
  - Increases drying rate
  - Reduces respiratory loss
  - Increases TDN
  - Conditioning for drying stems!
  - Wide swath for drying Leaves!

Harvesting High Quality Forage

- Start harvesting when forage at desired quality
- Mow, condition, put in wide swath
- Harvest at appropriate moisture
Moisture for Baling

<table>
<thead>
<tr>
<th>Square bales</th>
<th>Medium (3'x3')</th>
<th>Large (4'x4')</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture for safe baling without mold</td>
<td>&lt;20%</td>
<td>&lt;16%</td>
</tr>
</tbody>
</table>

| Round Bales | <5' dia | <6' dia | <18% | <16% |

Heating can lead to fire

Sept 24, 2013 A load of hay on a semi caught fire on I-80 in Iowa

Sept 27, 2013
YOLO COUNTY, Calif. — A massive fire at a hay export business is estimated to have caused at least $6 million in damage so far.

Hay Preservation – Results of Malliard Reaction

- TDN = dNFC + dCP + 2.25*FA + dNDF - 7

<table>
<thead>
<tr>
<th>TDN losses (% of DM)</th>
<th>Number of samples</th>
<th>Percent of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0</td>
<td>911</td>
<td>25</td>
</tr>
<tr>
<td>0-4.0</td>
<td>894</td>
<td>25</td>
</tr>
<tr>
<td>4.0-8.0</td>
<td>1221</td>
<td>34</td>
</tr>
<tr>
<td>8.0-12.0</td>
<td>517</td>
<td>14</td>
</tr>
<tr>
<td>&gt;12.0</td>
<td>69</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>3612</td>
<td></td>
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With corn at $4.50/bu, TDN is 7¢/lb
TDN losses of farmer submitted samples to forage testing laboratories

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<td>0 - $5.60</td>
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<tr>
<td>4.0-8.0</td>
<td>1221</td>
<td>34</td>
<td>$5.60 - $11.20</td>
</tr>
<tr>
<td>8.0-12.0</td>
<td>517</td>
<td>14</td>
<td>$11.20 - $16.80</td>
</tr>
<tr>
<td>&gt;12.0</td>
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<td>&gt;$16.80</td>
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With corn at $4.50/bu, TDN is 7¢/lb

Making Good Silage

- Harvest at maturity for high quality
- Dry to or harvest at correct moisture
- Chop to correct length
- Pack well
- Fill rapidly
- Cover

Inoculants

- Silage additives whose main ingredients are lactic acid producing bacteria

Different Types of Inoculants

- Traditional homofermentative types:
  - *Lactobacillus plantarum*, *L. casei*, *Pediococcus* species, *Enterococcus faecium*
  - *Lactobacillus buchneri*, a heterofermenter
- Combination of homofermenters with *L. buchneri*

End Product Comparison

- Lactic acid - strong acid; weak spoilage inhibitor; fermented in rumen
- Acetic acid - weak acid; good spoilage inhibitor; not fermented in rumen
- Ethanol - neutral; poor spoilage inhibitor; partially fermented in rumen
- Carbon dioxide - lost dry matter

So…

- If you want to preserve crop quality:
  - Lactic acid
- If you want a silage that doesn’t heat:
  - Acetic acid
- In any case, you want to minimize ethanol & CO₂
Making Good Silage

- Harvest at maturity for high quality
- Dry to or harvest at correct moisture
- Chop to correct length
- Pack well

Why Is Silage Density Important?

High Density → less Dry Matter Loss
(Filling, Storage, Feedout)

High Density → more storage capacity

Want less than 0.40 porosity

- Porosity is a measure of the air spaces in silage

Packing Density

- 15 cm thick layers
- Heavy tractors
  - With added weight
  - Wheels well lugged, high tire pressure
- Fill by progressive wedge method
- Drive over entire surface
- Multiple passes

http://www.uwex.edu/ces/crops/uwforage/storage.htm
Harvesting High Quality Forage

- Start harvesting when forage at desired quality
- Mow, condition, put in wide swath
- Harvest at appropriate moisture
- Pack silage well

Web Resources

UW Extension Forage Resources
www.uwex.edu/ces/crops/uwforage/uwforage.htm

UW Extension Corn Agronomy
http://corn.agronomy.wisc.edu/Extension.htm

UW Department of Dairy Science
http://www.wisc.edu/dysci/