Rate of Yield and Quality Change in Alfalfa

Idaho Alfalfa and Forage Conference
Twin Falls, Idaho
February 27 - 28, 2006

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Harvest management - it's come a long way…

<table>
<thead>
<tr>
<th>Time</th>
<th>Goal</th>
<th>No. harvests</th>
<th>Growth stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1920-1950</td>
<td>Persistence, yield</td>
<td>1 – 2</td>
<td>Full flower</td>
</tr>
<tr>
<td>1950-1960</td>
<td>Nutrient yield, persistence</td>
<td>3</td>
<td>First flower</td>
</tr>
<tr>
<td>1970’s</td>
<td>Nutrient yield</td>
<td>4</td>
<td>First flower</td>
</tr>
<tr>
<td>1980’s</td>
<td>Nutrient conc.</td>
<td>4</td>
<td>Bud</td>
</tr>
</tbody>
</table>

Sheaffer, 1990
…but so has alfalfa variety development.

<table>
<thead>
<tr>
<th>Period</th>
<th>No. released/year</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1901 - 1940</td>
<td>0.33</td>
<td>Public</td>
</tr>
<tr>
<td>1941 - 1960</td>
<td>1</td>
<td>Public/private</td>
</tr>
<tr>
<td>1981 - 1985</td>
<td>17</td>
<td>Private/public</td>
</tr>
<tr>
<td>1986 - 1990</td>
<td>30</td>
<td>Private</td>
</tr>
<tr>
<td>1991 - 1995</td>
<td>60</td>
<td>Private</td>
</tr>
<tr>
<td>1996 - 2000</td>
<td>100</td>
<td>Private</td>
</tr>
</tbody>
</table>

USDA-ARS Alfalfa Crop Germplasm Comm., 2000
Harvest for yield or quality?

Greater yield returns more profit,

Undersander, 2001
BUT yield and quality are opposed.
Harvest for yield or quality?

- Alfalfa should be harvested at the quality that meets the dietary needs of the animals that will consume it, and is balanced with respect to other components of the diet.
Management goals dictate cutting date and interval.

Undersander et al., 2004
CUTTING SCHEDULE

YIELD (tons/acre)

% ADF

- >35
- 32-35
- 29-32
- 27-29
- <27

% of yield in each quality category

Low Quality

High Quality

Putnam et al., 2005
What is the trade-off between yield and quality during each harvest period?
Locations

southcentral Idaho

central Pennsylvania

southcentral Wisconsin
<table>
<thead>
<tr>
<th>Variety</th>
<th>Source</th>
<th>Advertised traits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affinity+Z</td>
<td>ABI</td>
<td>disease resistance, fall dormancy 4, full season, fast recovery, traffic tolerance</td>
</tr>
<tr>
<td>Standfast</td>
<td>CalWest</td>
<td>lodging resistance, fall dormancy 4/5, fast recovery (reach late bud 3 - 5 days faster)</td>
</tr>
<tr>
<td>WL-346</td>
<td>WL Research</td>
<td>insect/disease resistance, fall dormancy 4, fast recovery</td>
</tr>
</tbody>
</table>
Early summer

Late summer

Fall

Yield - quality relationships in spring

0 d  5 d  10 d  15 d  20 d

Late Vegetative (stem > 12", no buds)

1/10 bloom

1/10 bloom

1/10 bloom
Yield - quality relationships in early summer

0 d  5 d  10 d  15 d  20 d

Spring

1/10 bloom

Late summer

1/10 bloom

Fall

1/10 bloom

Late Vegetative
(stem > 12", no buds)
Forage quality perspectives

completely digestible

partially digestible
First cut yield for each harvest period *

*No differences found among varieties
1st cut NDFD for each harvest period *

*No differences found among varieties
Idaho: yield vs. cell wall digestibility

Change in yield (lb/acre) per day

Change in NDFD (%) per day
Pennsylvania: yield vs. cell wall digestibility

Yield (lb/A)

Spring
Early sum.
Late sum.
Fall

Days

NDFD (%)

Spring
Early sum.
Late sum.
Fall

Days
Wisconsin: yield vs. cell wall digestibility

**Graph 1:**
- **Yield (lb/A)**
- **Days**
- **Legend:**
  - Spring
  - Early sum.
  - Late sum.
  - Fall

**Graph 2:**
- **NDFD (%)**
- **Days**
- **Legend:**
  - Spring
  - Early sum.
  - Late sum.
  - Fall

- Harvest 1
- Harvest 2
- Harvest 3
- Harvest 4

- Spring
- Early sum.
- Late sum.
- Fall

- Days: 0 5 10 15 20 25
- Yield (lb/A): 0 2000 4000 6000 8000
- NDFD (%): 40 45 50 55 60

- Spring:
  - Days: 0 5 10 15 20 25
  - Yield (lb/A): -0.4
  - NDFD (%): -0.4

- Early sum.:
  - Days: 0 5 10 15 20 25
  - Yield (lb/A): -0.4
  - NDFD (%): -0.3

- Late sum.:
  - Days: 0 5 10 15 20 25
  - Yield (lb/A): -20
  - NDFD (%): -0.4

- Fall:
  - Days: 0 5 10 15 20 25
  - Yield (lb/A): 90
  - NDFD (%): 0.4
Where does harvest management have the most impact?

More yield is impacted by forage quality changes that occur early in the growing season.

<table>
<thead>
<tr>
<th>Harvest period</th>
<th>Ib forage grown per % increase in NDF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ID</td>
</tr>
<tr>
<td>Spring</td>
<td>910</td>
</tr>
<tr>
<td>Early sum.</td>
<td>500</td>
</tr>
<tr>
<td>Late sum.</td>
<td>610</td>
</tr>
<tr>
<td>Fall</td>
<td>-</td>
</tr>
</tbody>
</table>
Questions or comments?