Alternative Forages: Quality and Management

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MONTANA STATE UNIVERSITY
BOZEMAN, MT
Outline

• What species are available
  – Current research in MT
  – Forage Quality analysis

• Anti-quality factors to consider
Species to consider

- Wheat
- Barley
- Oats
- Rye
- Triticale
- Millet
- Sorghum
- Sudan
- Peas
- Lentils
- Beets
- Turnips
- Clovers
- Vetch
- Safflower
- Canola
- Flax
- Sunflower
- Radish
- Mustard
- Corn
How to choose?

• Many options- pick which works best for individual situation
  – Cereals- high yielding, high quality, flexibility
  – Brassicas- retain quality late, good for late fall/early winter forage
  – Warm seasons- good drought and heat tolerance, high yielding
  – Pulses- great quality, green manure source, water thrifty
Early Planted Herbage Mass Production
Lbs/ acre

Source: Kent McVay. Evaluation of Multiple Species for use as Cover Crops in Dryland Production in Montana.
<table>
<thead>
<tr>
<th>Cool Season Mix</th>
<th>Warm Season Mix</th>
<th>Alternative Mix</th>
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Source: Kent McVay. Evaluation of Multiple Species for use as Cover Crops in Dryland Production in Montana.
Early Planted Herbage Mass Production
State Average

Source: Kent McVay. Evaluation of Multiple Species for use as Cover Crops in Dryland Production in Montana.
Late Planted Herbage Mass Production
Lbs/ acre

Source: Kent McVay. Evaluation of Multiple Species for use as Cover Crops in Dryland Production in Montana.
Late Planted Herbage Mass Production
Statewide Average

Source: Kent McVay. Evaluation of Multiple Species for use as Cover Crops in Dryland Production in Montana.
Impact of planting date on above ground biomass accumulation of mixed species plantings averaged across locations.

Source: Kent McVay. Evaluation of Multiple Species for use as Cover Crops in Dryland Production in Montana.
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- Each plot harvested at flower
- Mixes- when the grass species began to flower
| Established | Cover Crop          | CP | ADF | NDF | TDN | RFV | NO$_3$
|-------------|---------------------|----|-----|-----|-----|-----|-----
<p>| Early       | Hairy Vetch         | 28 | 26  | 28  | 65  | 232 | 719 |
|             | Alsike Clover       | 21 | 25  | 31  | 63  | 215 | 195 |
|             | Pea                 | 20 | 25  | 34  | 66  | 193 | 273 |
|             | Warm Season Mix     | 21 | 27  | 34  | 61  | 205 | 1294|
|             | Turnip              | 19 | 30  | 33  | 57  | 208 | 3448|
|             | Safflower           | 18 | 28  | 35  | 62  | 181 | 1086|
|             | Alternative Mix     | 20 | 28  | 36  | 60  | 182 | 1991|
|             | Radish              | 18 | 28  | 37  | 58  | 176 | 2100|
|             | Diversity Mix       | 17 | 26  | 44  | 66  | 146 | 1110|
|             | Cool Season Mix     | 16 | 28  | 45  | 65  | 141 | 955 |
|             | Canola              | 17 | 32  | 44  | 60  | 142 | 1778|
|             | Oat                 | 13 | 30  | 53  | 65  | 115 | 884 |
|             | Flax                | 14 | 35  | 51  | 61  | 115 | 162 |
|             | Spring Triticale    | 13 | 35  | 62  | 62  | 92  | 526 |
|             | average             | 18 | 29  | 40  | 62  | 167 | 1180|</p>
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MREDI Trial Costs

- Note - always calculate seeding rates on a pure live seed (PLS) basis

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Grazing Trial - Bozeman
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<th>Initial DM Herbage Mass (kg ha⁻¹)</th>
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- No correlation between preference and any nutrient level
How do pulses stack up?
Table 3. Hay yield and quality at Amsterdam, MT, 2003 and 2005.

<table>
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<tr>
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<th>Crude protein g kg(^{-1})</th>
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P-values

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Mean values for the ‘Flower’ and ‘Pod’ Hay Harvest Timings

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Crop means at the ‘flower’ and ‘pod’ harvest timings for pea hay harvest

Table 3. Hay yield and quality at Amsterdam, MT, 2003 and 2005.

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<tr>
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<th>Hay yield Mg ha(^{-1})</th>
<th>Relative Feed Value</th>
<th>Crude protein g kg(^{-1})</th>
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Mean values for the ‘Flower’ and ‘Pod’ Hay Harvest Timings

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<td>168</td>
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<td>6.85</td>
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Crop means at the ‘flower’ and ‘pod’ harvest timings for pea hay harvest

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Table 3. Hay yield and quality at Amsterdam, MT, 2003 and 2005.

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**P-values**

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**Crop means at the ‘flower’ and ‘pod’ harvest timings for pea hay harvest**

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What about warm-season grasses?
Warm season grass trial:
Bozeman, MT
Season Average

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<th>ADF</th>
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## Individual Harvests

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<td></td>
</tr>
<tr>
<td>1SB0001</td>
<td>PPS</td>
<td>3120</td>
<td>5241</td>
<td>20.1</td>
<td>19.5</td>
<td>64.0</td>
</tr>
<tr>
<td>1SU9002</td>
<td>PPS</td>
<td>4310</td>
<td>6858</td>
<td>20.4</td>
<td>18.9</td>
<td>59.8</td>
</tr>
<tr>
<td>1SU7006</td>
<td>BMR</td>
<td>3427</td>
<td>7161</td>
<td>19.8</td>
<td>17.9</td>
<td>61.6</td>
</tr>
<tr>
<td>14SU7003</td>
<td>CON</td>
<td>4157</td>
<td>6115</td>
<td>19.6</td>
<td>17.8</td>
<td>67.2</td>
</tr>
</tbody>
</table>

- Denotes a significant impact of rep (Rep 1> Rep 2> Rep 3), indicating impacts of field placement on results
- <sup>a,b</sup> in title column denotes a significant impact of harvest on results
Forage Quality Analysis - Recommendations

• Always test
• So much variability
  – Within species
  – Location
  – Harvest date
• Base feeding recommendations off analysis
• Look at energy (TDN), protein, and nitrates
  – Minerals?
Forage Quality Analysis

• Harvest timing should be based off needs
• Earlier harvest -> increased quality but decreased yield
  – Cereals- early heading or soft dough?
  – Peas- depends on goals
    • Water use increases past first bloom, but so does yield
  – Warm season- ??
    • Decreased risk for nitrates and prussic acid
• Brassicas- leaf loss at later maturity
  • Plant after June 15 to prevent bolting
Anti-Quality Factors

- Nitrates “widest-spread” concern
- Does the QuikTest work?
  - Are there any other tests available for producers?
Nitrate Research-Test Evaluation

Recommended Nitrate Levels for Feeding Livestock

<table>
<thead>
<tr>
<th>Nitrate (ppm)</th>
<th>Recommendation for feeding</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1500</td>
<td>Generally considered safe for all livestock.</td>
</tr>
<tr>
<td>1500-5000</td>
<td>Limit to 50% for calves, pregnant, or lactating animals.</td>
</tr>
<tr>
<td>5000-10,000</td>
<td>Limit to 25-50% feed.</td>
</tr>
<tr>
<td>&gt;10,000</td>
<td>Do not feed to pregnant animals. Do not feed as is. Can cause animal mortalities.</td>
</tr>
</tbody>
</table>
Nitrate QuikTest

Pros
• Quick
• Easy
• Cheap
• Can do in-field
• Same day results

Cons
• Only certified personnel allowed
• Acid is extremely caustic
• Is it reliable?
Nitrate Strip Tests

Pros
- Quick
- Easy
- Commercially available
- No certification required
- More “defined” results

Cons
- Higher cost to producer
- Takes a little longer than QuikTest
- Reliability?

<table>
<thead>
<tr>
<th>Nitrate Strip Test Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrate (ppm)</td>
</tr>
<tr>
<td>Strip Test Color</td>
</tr>
</tbody>
</table>

Strip Tests used to sample forages with different levels of nitrates.

Top: Barley (>10,000 ppm nitrate)
Middle: Corn (1500-5000 ppm nitrate)
Bottom: Alfalfa (1500-5000 ppm nitrate)
Nitrate QuikTest Compared to Lab Results

- Accurately estimated levels compared to lab analysis 69% of the time (44/64 samples)

- Of the 31% that were incorrect, 87% of those were false negative (31% overall)

$P = 0.0019$

Yes = nitrates present    No = nitrates absent
Nitrate Strip Test Compared to Lab Results

$P = < 0.0001$

Strip Test Categories
1: < 1500 ppm
2: 1500-5000 ppm
3: 5000-10,000 ppm
4: < 10,000 ppm

- Correctly estimated results compared to lab analysis 73% of the time (true positive; 53/73 samples)

- 45% of the incorrect tests (12% overall) were false positive (overestimated; 9/20)

- Remaining 55% (15% overall) were false negative (underestimated; 11/20)
Nitrate Strip Test Results Separated by Year

<table>
<thead>
<tr>
<th>Strip Test Result (nitrate ppm)</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1500-5000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5000-10,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Others to think about

• Prussic acid
  – Test strips available
  – Otherwise, hard to test for
  – WSG (sorghum highest)

• Photosensitivity
  – Buckwheat
  – Some clovers

• Sweet clover toxicity
  – Only in hay, not grazed
Questions?
emily.glunk@montana.edu
406-994-5688
Nitrate Strip Test Results Separated by County

Strip Test Result (nitrate ppm)

County

- Big Horn
- Custer
- Dawson
- Fallon/Carter
- Lewis and Clark
- Pondera
- Powder River
- Prairie
- Ravalli
- Sheridan
- Teton
- Valley
- Yellowstone
Nitrate Strip Test Results Separated by Treatment

Strap Test Result (nitrate ppm)

- Alalfa
- Barley
- Barley Mixture
- Cereal Mixture
- Corn
- Corn Silage
- Cover Crop
- Grass
- Oats
- Silage
- Spring Wheat
- Triticale
- Weeds
- Wheat
- Winter Wheat
- Warm Season Grass

Legend:
- <1500 ppm
- 1500-5000 ppm
- 5000-10,000 ppm