Alfalfa Winter Survival and Strategies for Injured Stands

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Use Winter Survival Index (WSI) Ratings

- UW/UMN fee-based trial
- Stressful seeding year cutting of spaced plants – maximize stress
- Score for injury the following spring
- 1 though 6
- We need WSI of 3 or less
- 2 or less if fall cutting routinely
Management Factors Affecting Alfalfa Winter Injury Potential

- Cultivar – WSI and disease resistance
- Stand age
- Soil K and pH
- Soil drainage of site
- Harvest frequency
- Fall cutting and timing
- In mixture with grass?
Climatic Factors Affecting Alfalfa Winter Injury Potential

- Snow cover
- Temperature
  - Fall and winter
  - Cold vs. alternating
- Moisture
  - Summer, fall, and winter
- Fall hardening conditions - sunlight
- Ice sheeting
Fall Harvesting based on GDD - Pintendre, Quebec 46° clay loam

- 2 Harv
- 3X (400 GDD, 9/10)
- 3X (500 GDD, 9/23)
- 3X (600 GDD, 10/12)
Fall Harvest based on GDD - Normandin, Quebec 48° 50’ silty clay

- 2 Harvests
- 3X (400 GDD, 9/10)
- 3X (500 GDD, 9/23)
- 3X (600 GDD, 10/12)
Winter Soil Temperatures in Quebec Study

- Sometimes lower where fall-harvested, but generally only a degree or two
- Often not much below freezing (32 F) – snow cover
- Lower temps at Normandin, lowest peak was 16 F in 1st winter
- 2nd winter at Normandin, between 10 and 18 for ~3 weeks is what nailed the alfalfa
Potential to Reduce Alfalfa Winter Injury by Mixing with Grass

- Greater snow catch and insulation? Reduced winter injury? Sited by 2 major alfalfa management references (no data!)
- More rapid hay drying
- RFQ treats grasses with respect
- Less potential for traffic damage?
  - Soil/crown protection?
  - Finish field operations more quickly
- Perennial grass options for aggressive cutting schedules
  - Reed canarygrass, orchardgrass
  - Tall fescue, perennial ryegrass, festulolium (shorter stands)
- Annual/Italian ryegrass nurse crops
Annual/Italian ryegrass as nurse crop

- Seeding rate?
  - 4-5 lb/ac can be too much
- Seeding pattern/method
  - Broadcast alfalfa best
- Ryegrass nomenclature
  - Vernalization?
- Fall cutting necessary
- Potential for ryegrass to provide more winter cover/insulation
Italian Ryegrass in Stearns Co., Aug. 2004
### Italian and annual ryegrass yields in Stearns Co., 2004
(Seeded 30 April 2004, 5 harvests, Univ. of MN and Barenbrug USA)

<table>
<thead>
<tr>
<th>Variety</th>
<th>Description</th>
<th>DM Yield (T/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barextra</td>
<td>Tetraploid Italian ryegrass, veg.</td>
<td>6.5</td>
</tr>
<tr>
<td>Jumbo</td>
<td>Tetraploid annual ryegrass, head</td>
<td>6.4</td>
</tr>
<tr>
<td>Bardelta</td>
<td>Diploid Italian ryegrass, veg.</td>
<td>6.2</td>
</tr>
<tr>
<td>LM 270</td>
<td>Diploid annual ryegrass, head</td>
<td>6.0</td>
</tr>
<tr>
<td>Baridana</td>
<td>Orchardgrass, veg.</td>
<td>3.7</td>
</tr>
<tr>
<td>Jim</td>
<td>Oat, boot</td>
<td>2.3</td>
</tr>
</tbody>
</table>
**Italian ryegrass forage quality and milk production potential in Stearns Co., 2004**
(Seeded 30 April 2004, 4 harvests, Univ. of MN and Barenbrug USA)

<table>
<thead>
<tr>
<th>Variety</th>
<th>Descr.</th>
<th>Harvest(s)</th>
<th>DM Yield (T/Ac)</th>
<th>RFQ</th>
<th>RFV</th>
<th>Milk/Ton</th>
<th>Milk/Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barestra</td>
<td>4X IRG</td>
<td>4 harvests</td>
<td>6.5</td>
<td>193</td>
<td>143</td>
<td>3,130</td>
<td>19,000</td>
</tr>
<tr>
<td>Bardelta</td>
<td>2X IRG</td>
<td>4 harvests</td>
<td>6.2</td>
<td>181</td>
<td>138</td>
<td>3,030</td>
<td>17,500</td>
</tr>
<tr>
<td>Barestra</td>
<td>4X IRG</td>
<td>Sept. 27</td>
<td>1.5</td>
<td>164</td>
<td>119</td>
<td>2,930</td>
<td>4,480</td>
</tr>
<tr>
<td>Bardelta</td>
<td>2X IRG</td>
<td>Sept. 27</td>
<td>1.3</td>
<td>150</td>
<td>111</td>
<td>2,750</td>
<td>3,520</td>
</tr>
<tr>
<td>Baridana</td>
<td>OG</td>
<td>Sept. 27</td>
<td>1.1</td>
<td>124</td>
<td>101</td>
<td>2,160</td>
<td>2,400</td>
</tr>
</tbody>
</table>
Italian Ryegrass vs. Oats at Dan Miller Farm, 2004
Keller Farm, Lake City, MN

- October 16, 2003
- 2.0 ton haylage/ac (0.9 ton DM/ac)
- RFV = 189
- RFQ = 203
Sapa Ska Farm, May 13, 2003
Sapa Ska Farm, May 29, 2003
Fall Cutting/Residue Thinking

- Consider all factors that contribute to risk of winter injury (A.M.G. p.52)
- Fall harvest can provide ~ 1 ton/ac of high quality forage
- Fall residue can reduce quality of the first harvest next spring
  - May depend on snow conditions
  - May warrant clipping/removal
- No detrimental effect of fall cutting on yields the following year in two on-farm SE MN farms
  - Substantiates research studies in MN and ND
- Seeding year stands are often best candidates for fall cutting
Diagnosis

Winterkill - can be severe

Farson, Wyoming Spring of 1996

Diseased

Dead

Close up of dead and dying plants

Photos from Fred Gray
Univ. Wyoming
Symptoms of BRR

- Dead or stunted plants in 2- to 3-year-old fields
- Taproots with various stages of rot
- Circular, shrunken lesions with black borders
- Coalesced lesions girdle root
- Soft rot from secondary bacteria
- Recommend DNA test to confirm diagnosis
BRR Update

- More sensitive test in Samac’s lab revealing lots of BRR fungus around, just not necessarily causing infection.
Winter Injury
<table>
<thead>
<tr>
<th>Stand age</th>
<th>Plants/Sq Foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seeding year</td>
<td>20 or more</td>
</tr>
<tr>
<td>First year</td>
<td>12 or more</td>
</tr>
<tr>
<td>Second year</td>
<td>8 or more</td>
</tr>
<tr>
<td>Third year</td>
<td>5 or more</td>
</tr>
</tbody>
</table>
Plant density

- Plant density is not a good indicator of yield
  - Stands should have at least 6 plants/ft$^2$

- Stems are a good indicator of yield potential
  - Stands should have at least 40 stems/ft$^2$
Alfalfa Stem Count and Yield Potential

![Graph showing the relationship between stems per square foot and dry matter yield (t/a)]
## Stand Evaluation

### Table 2. Stand Density Recommendations

<table>
<thead>
<tr>
<th>Stand Density (Stems/ft²)</th>
<th>Action</th>
<th>Predicted Yield Potential (Assuming no winterkill)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;55</td>
<td>Stem density not limiting yield</td>
<td>Same as current year</td>
</tr>
<tr>
<td>40 to 55</td>
<td>Some yield reduction</td>
<td>If good health, same as current year</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If &gt;30% in category 4, significantly less</td>
</tr>
<tr>
<td>&lt;39</td>
<td>Consider replacing stand</td>
<td>If good health, same as current year</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If &gt;30% in category 4, significantly less</td>
</tr>
</tbody>
</table>
Winterkilled alfalfa plants
Root damage assessment

- Dig up plants (4-6 inches) and examine roots. Don’t destroy stand until you do this.
- Healthy roots should be firm and white in color; little evidence of root rot.
- Winter injury early = gray, water-soaked appearance just after thawing
- Later becomes brown, dehydrated and stringy.
More Alfalfa root damage assessment.

- If the root is soft and water can be easily squeezed from it, or is brown, dry and stringy it is winter killed.

- If root is 50% or more of the root is blackened from root rot, the plant will most likely die during spring green up or later in the year.

- Healthy stands have fewer than 30% of plants in categories 3 and 4.
Rating 0
Large crown, symmetrical, many shoots.
Off-white roots with few signs of discoloration. Excellent winter survival.

Rating 1
Large crown, less symmetry, many shoots.
Off-white roots beginning to show signs of discoloration. Excellent winter survival.

Rating 2
Smaller crown, poor symmetry, fewer shoots.
Evidence of crown rot, vascular discoloration 3 to 4 inches deep. Roots may show one or both symptoms. Good winter survival.
Rating 3
Weak crown, less symmetry, fewer shoots.
Significant crown rot and root discoloration. Good survival in mild winters; poor survival in hard winters.

Rating 4
Complete lack of symmetry, few shoots.
Root rot affects more than 50% of the root's diameter, significant vascular discoloration. Not likely to survive winter.

Rating 5
Dead plants.
Stand Evaluation –
Use Photos and chart to rate and categorize plants

<table>
<thead>
<tr>
<th>Rating</th>
<th>Condition</th>
<th>Winter Survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Healthy</td>
<td>Excellent</td>
</tr>
<tr>
<td>1</td>
<td>Some Discoloration</td>
<td>Excellent</td>
</tr>
<tr>
<td>2</td>
<td>Moderate Discoloration/Rot</td>
<td>Good</td>
</tr>
<tr>
<td>3</td>
<td>Significant Discoloration/Rot</td>
<td>Good for mild winter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Poor for hard winter</td>
</tr>
<tr>
<td>4</td>
<td>Greater than 50% Discoloration</td>
<td>Poor</td>
</tr>
<tr>
<td>5</td>
<td>Dead</td>
<td>---------------</td>
</tr>
</tbody>
</table>
Alfalfa Root, Soft to squeeze, appeared to be deteriorating
Early April 2003 by Dan Martens UMES
Management practices following winter injury

- Allow alfalfa plants to mature longer before cutting. Severely injured = go to nearly full bloom in first cut than early flower in later cuts. Mild injury = 10 to 25% bloom before cutting.

- Increase cutting height because of new shoots at base of plant.

- Fertilize, control weeds and No Late Fall Cutting to allow for buildup of food reserves.

- Or push stands with plan to terminate after this year.
Alfalfa Replacement Strategies

- Oats and barley best for quick yield
- Adding peas boosts quality and palatability and broadens harvest window
- Corn silage best choice for tonnage regardless of planting date
- Sorghums are warm-weather crops
- Sudangrass and sorghum-sudangrass hybrids yielded equal to or slightly less than corn silage.