Managing Foliar and Root Diseases of Alfalfa for Improving Yield and Persistence

Deborah A. Samac  
Research Plant Pathologist  
Plant Science Research Unit  
Saint Paul, MN  

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Alfalfa was an early immigrant

Niels Hansen
First USDA plant explorer

American Scientist, 89 (3): 252

2000→China from USA
Alfalfa breeding in the US

- Anthracnose: 1971
- Phytophthora root rot: 1973
- Stem nematode: 1975
- Fusarium wilt: 1980
- Verticillium wilt: 1983
- Aphanomyces root rot: 1990
Historical Yields of Major Crops

USDA-NASS, 2012
Alfalfa Pathogens

- Fungi
- Oomycetes
- Nematodes
- Bacteria
- Viruses

*Fusarium oxysporum*-Fusarium wilt
Alfalfa Pathogens

- **Fungi**
- **Oomycetes**
- **Nematodes**
- **Bacteria**
- **Viruses**

*Phytophthora medicaginis*-Phytophthora root rot

Oospores long lived in soil. Oomycetes AKA “water molds”
Oomycete Diseases of Alfalfa

- Phytophthora root rot
- Aphanomyces root rot
- Pythium seed rot and damping off

- Most serious in wet soils
Disease resistance increases yield

Phytophthora root rot

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Percent resistant plants</th>
<th>Waseca (tons/ha)</th>
<th>Grand Rapids (tons/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agate</td>
<td>48</td>
<td>11.0</td>
<td>9.8</td>
</tr>
<tr>
<td>Saranac</td>
<td>2</td>
<td>9.5</td>
<td>8.5</td>
</tr>
<tr>
<td>Weevlchek</td>
<td>1</td>
<td>9.2</td>
<td>8.5</td>
</tr>
<tr>
<td>Vernal</td>
<td>5</td>
<td>8.8</td>
<td>8.5</td>
</tr>
</tbody>
</table>

Aphanomyces root rot

Seedling “corpses”

Acute phase

Adult plants lack lateral and fibrous roots, no nodules. Foliage stunted, yellow. Chronic phase.
Aphanomyces root rot
Pathogen diversity

• Two races of alfalfa pathogen identified by host genetics
  – Race 1 resistance in most cultivars
  – Failure of race 1 resistance

• Failure of race 1+2 resistant cultivars
  – Are there additional races?
Race 2 is most common

Races in western US?

- No evidence for “Race 3”
- Atypical responses due to other pathogens
Seed Treatment for ARR

Percent Protected Plants

Seed Treatment

Control  Apron  Stamina  Resistant Cv
Strategies for managing ARR

- Good soil drainage
- Liming to pH 6.5-8
- Balanced P, K, micronutrients
- Resistant cultivars (race 1+2)
- Stamina fungicide provides seedling protection
Pre- and post-emergence damping off

• Reduces initial stand density
• Chronic reduction in root function
  – “forked” roots
Seed treatments

- Conventional treatment with ApronXL
- Enhances PRR resistance
- Reduces seed rot and damping off

<table>
<thead>
<tr>
<th>Pythium ultimum</th>
<th>Control</th>
<th>Apron</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial 1</td>
<td>2%</td>
<td>63%</td>
</tr>
<tr>
<td>Trail 2</td>
<td>37%</td>
<td>83%</td>
</tr>
</tbody>
</table>

Edmisten et al. (1988) Crop Sci. 28:568
Seed rot and damping off pathogens

- *Pythium* species
  - Alfalfa pathogens: three major species
  - Corn and soybean pathogens are pathogenic on alfalfa
- Stamina fungicide not effective
- Resistance to Apron in ~50% of isolates
- *Fusarium* species causing seed rot
Strategies for managing damping off

- Good soil drainage
- Seed treatments with ApronXL + fungicide
- Higher seeding density has limited effect
- Crop rotation may have limited effect
- Resistance is needed!
Foliar Fungicides in Alfalfa Production

- **Headline**: Labeled for pure alfalfa, up to 3 applications per year
- **Quadris**: Can be applied to mixed grass/alfalfa stands, same class as Headline
- **Endura**: Boscalid
- **Fontelis**: Penthiopyrad, label approved for alfalfa in 2013
- **Kocide 3000**: copper hydroxide
Headline Studies in WI and MN

2012: 5 locations
2013: 3 locations
Spring Black Stem and Leaf Spot

Fungicide Treated

Control
Spring Black Stem and Leaf Spot Symptoms
First Harvest 2013
Beef Hay Harvest

Insecticide + Headline

Insecticide
Mid-season Foliar Diseases

Spring black stem and leaf spot

Lepto leaf spot

Summer black stem and leaf spot
Results Summary

• 6/26 (23%) dairy quality trials with a significant increase in yield (0.1-0.2 tons/acre)
• 5/15 (33%) beef quality trials with a significant increase in yield
• 1-2 treatments/year may improve stand persistence
Compendium of Alfalfa Diseases and Pests

- 54 diseases
- Major insect pests
- Abiotic disorders
- 250 color photos
- Worldwide scope
- Available from APS Press ($99)

www.apsnet.org
Thank You!
Questions?