

# Root and Crown Rots and Virus Diseases of Alfalfa and Clover

by **Dean Malvick**, Assistant Professor of Plant Pathology  
Department of Crop Sciences  
University of Illinois at Urbana-Champaign

A goal for many forage producers is to plant alfalfa and clover, harvest high yields on an appropriate schedule, and retain stands for many years. Numerous obstacles, however, prevent this ideal scenario. Of those obstacles, diseases are among the most damaging. Diseases affect yield, persistence, and quality of forage crops and frequently force premature reestablishment of stands. Many diseases affect roots, leaves, stems of alfalfa and red clover from the seedling to established stages. Three diseases that are particularly damaging will be emphasized in this presentation: *Aphanomyces* root rot of alfalfa, crown rots of alfalfa, and clover yellow mosaic virus.

## The Race is On for *Aphanomyces* Root Rot

One of the first diseases that often occurs after planting is *Aphanomyces* root rot. This disease, caused by the fungal-like pathogen *Aphanomyces euteiches* causes death and poor growth of seedling alfalfa in slowly drained fields. It also can be a chronic disease of established plants that may result in significant yield reduction. *Aphanomyces* root rot is similar to, and may occur in a complex with, *Phytophthora* root rot and *Pythium* damping off, diseases which also occur in wet or slowly drained soils (3). Plants infected with *Aphanomyces* usually are stunted and chlorotic before they wilt and die, whereas *Phytophthora* and *Pythium* tend to kill seedlings quickly before plants become severely chlorotic. Another clue to a potential problem with *Aphanomyces* is stunting and poor nodulation of an alfalfa cultivar that is highly resistant to *Phytophthora*. *Aphanomyces* root rot has also been related to increased damage to alfalfa from winter root heave damage (9). Perhaps because root rot of alfalfa that occurred in slowly drained soil was attributed to *Phytophthora*, *Aphanomyces* root rot was not recognized as a serious problem until the early 1980's. *Aphanomyces* root rot is known to be a widespread problem for alfalfa in Wisconsin (4). Although *Aphanomyces* can infect red clover, it appears to be a minor problem on that crop (2).

*Aphanomyces* root rot of alfalfa can best be managed by avoiding slowly-drained soils and by using *Aphanomyces*-resistant alfalfa varieties. Fungicides are not available for control of *Aphanomyces*. *Phytophthora* and *Pythium* seed and root rots can be controlled with fungicidal seed treatments such as Allegiance-FL, ApronXL, or Apron-FL. These seed treatments are not effective against *Aphanomyces*. Alfalfa varieties rated highly resistant (HR) or resistant (R) to *Aphanomyces* root rot should be planted where slowly-drained soils occur and where *Aphanomyces* may be a problem (6, 8). Management of *Aphanomyces* root rot clearly became more challenging when different races of this pathogen were discovered.

*Aphanomyces* root rot of alfalfa is caused by two races of *Aphanomyces*. One race (race 1) was initially discovered and was used for development of most alfalfa cultivars with *Aphanomyces* resistance. Another race (race 2) was discovered that can kill and stunt cultivars that have resistance only to race 1. The frequency of race 1 and race 2 isolates were studied from 13 fields in Wisconsin (5). *Aphanomyces* isolates (total number = 405) were collected from the fields. The race of the isolates was determined by inoculation of Saranac (susceptible to races 1 and 2) and WAPH-1 (resistant to race 1) alfalfa varieties. The populations of the two races of *Aphanomyces* varied among the different Wisconsin fields. For example, 51 percent were race 2 in a field never used for alfalfa production and 27

percent of isolates were race 2 from a field used for pea production, while 43 percent of all isolates from fields with a history of alfalfa production were race 2. Race 2 isolates appear to be widespread in Wisconsin and other Midwestern states and this race of *Aphanomyces* occurs in fields with varied cropping histories.

Alfalfa varieties with resistance only to race 1 are vulnerable to *Aphanomyces* root rot in many areas due to the presence of race 2. Of eight alfalfa cultivars evaluated for resistance to both races in a recent study, all except those selected for R2 resistance were susceptible to R2 isolates (5). Several commercial alfalfa varieties are available that have resistance to both races of *Aphanomyces*. Race 2 isolates may represent a widespread risk to alfalfa cultivars with resistance only to race 1.

### Crown Rots in Alfalfa: Perils to Persistence

Crown rot of alfalfa can be as damaging as it is frustrating to manage. This disease complex occurs in nearly every established stand of alfalfa. The older the stand, the more crown rot that typically occurs (7). Typical initial symptoms of crown rot include brown dead tissue in the crown and root cortex, and this may spread to kill the entire root core and crown buds. While it is difficult to prevent crown rots, we can gain understanding of what causes them, what factors favor development of crown rot, and what management steps we can take to reduce or delay their development.

Several fungi are commonly associated in a complex with crown rot disease. They include *Phoma* spp., *Colletotrichum trifolii*, *Fusarium* spp., *Pythium* spp, and *Rhizoctonia solani*. These pathogens can also cause other symptoms/diseases including root rots and stem infections. Thus, they may infect plants months or even years before crown rot develops, and isolation of these pathogens from plants does not mean that crown rot will develop.

These pathogenic fungi may only cause crown rots under specific, stress conditions. Plant stresses that may favor crown rots include poor fertility, low soil pH, other diseases, harvesting too often or too late in the season, and grazing animals or wheel traffic that damages the crowns. Because of the complex nature of this disease, alfalfa varieties with high levels of specific resistance to crown rots have not been developed. Crown rot damage can be reduced by choosing and planting adapted varieties that have resistance to multiple diseases, and by maintaining sound management practices that consider the stresses related to crown rots noted above.

### Is Clover Yellow Mosaic Virus a New Danger?

Viruses are often unrecognized members of the large group of plant pathogens that infect alfalfa and clover. One of the most common pathogens in alfalfa is alfalfa mosaic virus (AMV). This virus is widespread in Wisconsin alfalfa fields. Fortunately, it rarely seems to cause any serious problems for alfalfa or red clover, but commonly infects plants without causing any obvious symptoms, damage, or yield loss. Another virus, clover yellow mosaic virus, can act quite differently than AMV and can be very damaging to red clover.

Clover yellow mosaic virus (CYMV) has recently been associated with severe damage to red clover in Wisconsin. Typical symptoms are a mosaic pattern and brown streaks on infected leaves (10). Recent studies by C. Grau and A. Mondjana (personal communication) in the Department of Plant Pathology at UW- Madison suggest this is a widespread virus that can be quite destructive and cause summer decline to red clover. It also infects alfalfa and pea, but has not been reported to cause significant damage to these crops in Wisconsin. Because CYMV is a newly reported problem, there is still much we do not

know about this virus in the Midwest. Based on current information, this virus may be transmitted by aphids or mechanically during harvest. As such, it will be very difficult to control the spread of this virus.

### References

1. Grau C. R. 1992. Registration of Waph-1 Alfalfa Germplasm with Resistance to *Aphanomyces* Root Rot. *Crop Science*. 32: 287-288.
2. Grau C. R., Muehlchen A. M., Tofte J. E., and Smith R. R. 1991. Variability in Virulence of *Aphanomyces euteiches*. *Plant Disease*. 75: 1153-1156.
3. Holub E. B., and Grau C. R. 1990. Ability of *Aphanomyces euteiches* to Cause Disease of Seedling Alfalfa Compared with *Phytophthora megasperma f. sp. medicaginis*. *Phytopathology*. 80: 331-335.
4. Holub E. B., and Grau C. R. 1990. Specificity of Resistance to *Aphanomyces euteiches* in Seedling Alfalfa. *Plant Disease*. 74: 164-168.
5. Malvick D. K., and Grau C. R. 2001. Characteristics and frequency of *Aphanomyces euteiches* races 1 and 2 associated with alfalfa in the Midwestern United States. *Plant Dis.* In-press
6. Munkvold G. P., Carlton W. M., Brummer E. C., Meyer J. R., Undersander D. J., and Grau C. R. 2001. Virulence of *Aphanomyces euteiches* isolates from Iowa and Wisconsin and benefits of resistance to *A. -euteiches* in alfalfa cultivars. *Plant Disease*. 85: 328-333.
7. Stuteville D. L., and Erwin D. C. e. 1990. *Compendium of Alfalfa Diseases*. Second Edition. St. Paul: APS Press. 84 pp.
8. Wiersma D. W., Grau C. R., and Undersander D. J. 1995. Alfalfa Cultivar Performance with Differing Levels of Resistance to *Phytophthora* and *Aphanomyces* Root Rots. *Journal of Production Agriculture*. 8: 259-264.
9. Wiersma D. W., Undersander D. J., and Grau C. R. 1997. Root heave of alfalfa cultivars with differing levels of resistance to *Aphanomyces* root rot. *Agronomy Journal*. 89: 148-150.
10. Website: Plant Viruses Online (<http://image.fs.uidaho.edu/videscr229.htm>)