

Phytophthora root rot



Alfalfa stem nematode



# Alfalfa Disease Management

Brown root rot



Verticillium wilt



Summer black  
stem and leaf spot



Yellow leaf blotch



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# UNIVERSITY OF WYOMING

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# Alfalfa Disease Management

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## INTRODUCTION

Alfalfa, *Medicago sativa* spp. *sativa* L., originated in the region of Asia Minor, Transcaucasia, Iran, and the highlands of Turkmenistan, where it has been cultivated since before recorded history (9). The oldest known reference to alfalfa is from Turkey (1300 BC) 3,300 years ago. The word “alfalfa” is Arabic meaning “good fodder.” Leaves and stems of alfalfa are high in protein and serve as an excellent and nutritious feed for many domesticated animals. From its point of origin, alfalfa has been spread by man to the far reaches of the globe. It was first successfully grown in the western U.S. about 1850 and is now grown in every state in the continental U.S. It is believed to have been introduced into the Wyoming Territory in the late 1800s. Today alfalfa is grown in all 23 counties within Wyoming. There are currently an estimated 620,000 acres of alfalfa grown for hay production, of which 440,000 acres are irrigated and 180,000 acres are grown under natural rainfall (dry-land) conditions. Additionally, an estimated 8,000 acres of alfalfa, most of which are located in the Wind and Big Horn River Valleys, are grown for seed production. Although forage production is greater under irrigation than under dry-

land (2.3 tons/acre versus 0.8 tons/acre), diseases are more numerous and damaging in irrigated fields. Since alfalfa seed fields are not irrigated as frequently as fields grown for forage, diseases are not only fewer but are also less severe.

Like most crops, alfalfa is attacked by many disease-causing organisms. Seedlings as well as seeds, stems, leaves, and roots of older plants all serve as food sources for a number of disease-causing organisms. Of the 80 different diseases that have been reported on alfalfa from North America (6), 16 have been identified in Wyoming. Other diseases may occur in the state but have not been detected. Crown rots, root rots, and wilts, which can cause plant death, are usually worse than leaf and stem diseases. Under certain conditions, seedling diseases can damage newly planted stands. The presence and severity of plant diseases are largely dependent on the cultivar planted and the environmental conditions present. Loss from leaf and stem diseases is usually worse in years having higher rainfall as well as in alfalfa grown under irrigation. Foliage diseases are usually worse in sprinkle-irrigated fields while loss from root and crown diseases is usually worse where alfalfa is grown under furrow irrigation.

## DISEASE IDENTIFICATION

Information on the 16 alfalfa diseases identified in Wyoming is presented in Table 1. Diseases are listed in alphabetical order. Age and plant part attacked, characteristic symptoms, distribution within the state, and suggested control practices are given. One or more colored photographs is provided for each disease. After reading Table 1, see if you can recognize any of these diseases. If you are not sure what diseases are present in your field, contact your University of Wyoming agriculture extension educator for instructions on submitting a diseased plant sample for positive identification.

### Stand Decline Diseases

In Wyoming the most damaging diseases of irrigated alfalfa, in order of importance, are **Verticillium wilt**, **Alfalfa stem nematode**, **Phytophthora root rot**, and **Brown root rot** (Disease No. 10, 14, 5, 2, Table 1). Both Alfalfa stem nematode and Brown root rot reduce stored carbohydrates and proteins in plant crowns and upper roots that are needed for winter survival and predispose plants to low-temperature injury and winterkill. All four of these diseases can cause a reduction in the plant stand and yield of susceptible varieties. Verticillium wilt results in the plugging of water-

conducting vessels and reduced movement of water and essential nutrients within a plant. Plants with Verticillium wilt usually die during the summer months. Alfalfa stem nematodes parasitize new stem buds prior to their emergence from the soil, resulting in severe swelling and stunting. Studies recently conducted by University of Wyoming researchers found the Chrysanthemum foliar nematode *Aphelenchoides ritzemabosi* as a co-habitant with Alfalfa stem nematode (*Ditylenchus dipsaci*) in diseased alfalfa stem and bud tissue. Although both of these nematodes may be present in alfalfa fields throughout the western U.S., reference will only be made to Alfalfa stem nematode for the purpose of brevity. Severely parasitized plants usually die during the winter months. Phytophthora attacks and kills seedlings and also causes root rot in older plants. Diseased plants may die anytime during the growing season or during the winter months. Brown root rot is a new disease in Wyoming, identified near Farson in Sweetwater County (elevation 6,800 feet) during 1996. This disease has been found to occur at most high elevation growing areas in the state where alfalfa is grown. It is associated with the periodic severe winterkill of plants. Additional information on these four important diseases are available (1, 4, 5, 8).

Table 1. Diseases of alfalfa in Wyoming.

Types of Diseases and Causes	Age and Plant Part Attacked					Symptoms and Distribution in State	Suggested Control Practices
	Seedling	Mature Plant					
		Stems	Leaves	Crown	Roots		
<b>Fungus</b>							
1. Anthracnose <i>Colletotrichum trifolii</i>		X	X	X		Dead, straw-colored shoots which curve downward in a "Shepard's Crook" (Plate 30). Diamond-shaped, tan lesions at base of diseased stems (Plate 31). Stems and crowns are attacked. Favored by hot, moist weather. Found only in eastern Wyoming.	Plant a resistant variety.
2. *Brown root rot <i>Phoma sclerotioides</i>				X	X	Symptoms are most noticeable in the early spring when plants may be dead or severely diseased and are slow to green up (Plates 9 and 10). Crown and upper tap and lateral roots are rotted (Plates 11 and 12). May be worse at higher elevations.	Two to three-year rotation with small grains. Avoid rotation with sweet clover. The Canadian variety Peace is resistant to BRR and is recommended in the Farson area in Sweetwater County. However, Peace may be susceptible to other stand declining diseases. It is not recommended in other areas of the state. Addition information on BRR can be found in Other Related Publications, No. 5.
3. Common leaf spot <i>Pseudopeziza medicaginis</i>			X			Small, circular, light chocolate brown spots on leaves (Plate 21). With age, small, raised light-colored disks develop in center of spots. Leaves turn yellow and drop off. Severe defoliation may occur (Plate 22). Found throughout the state at lower elevations and worse in the East and in the Wind and Big Horn River basins.	Plant resistant varieties in eastern Wyoming.

Table 1. Diseases of alfalfa in Wyoming (continued).

Types of Diseases and Causes	Age and Plant Part Attacked					Symptoms and Distribution in State	Suggested Control Practices
	Seedling	Mature Plant					
		Stems	Leaves	Crown	Roots		
4. Downy mildew <i>Peronospora trifoliorum</i>	X	X	X			Light green to yellow blotches on upper leaf surfaces (Plates 23 and 24). A grayish fungal growth develops on the underside of diseased leaves during periods of cool, rainy weather (Plate 25). If infection becomes systemic, growing points may be light green and deformed (Plate 26). Leaf loss does not occur. Worse at higher elevations. Occurs from Riverton to Powell and in high elevation, irrigated valleys (Laramie, Afton).	Plant a resistant variety.
5. *Phytophthora root rot <i>Phytophthora megasperma</i> f. sp. <i>medicaginis</i>	X				X	Root rot may occur on plants of any age (Plate 13). When soil remains wet, severe disease may occur in new seedlings (Plate 14). Young surviving plants may be stunted with yellow to red leaves and easily removed from soil. Roots of plants may be completely rotted off several inches from the soil surface (Plates 15 and 16). Occurs throughout the state. Worse in heavy clay soils where fields are furrow irrigated.	Plant a resistant variety in irrigated fields.* Protect seedlings with metalaxyl fungicide seed or soil treatment.
6. Sclerotinia crown and stem rot <i>Sclerotinia trifoliorum</i>	X	X	X	X		Small, brown spots on leaves and stems in fall. Diseased parts wilt and die (Plate 35). The crown becomes infected in the spring, turning brown and rotting with white fungal growth with hard black sclerotia (Plate 36). Plants less than 1 year old are most susceptible. Favored by moist, cool weather. In the fall during cool, wet, soil conditions, sclerotia located at or near the soil surface may germinate and produce small mushrooms called apothecia (Plate 37). Spores are released from apothecia and are wind disseminated. Only reported from a few seed fields in the Big Horn Basin.	Resistant varieties are not available. Fall burning of fields after harvest will reduce disease the following year. Rotate out diseased fields for two or three years with small grain or corn. Replant with certified seed in the spring.

Table 1. Diseases of alfalfa in Wyoming (continued).

Types of Diseases and Causes	Age and Plant Part Attacked					Symptoms and Distribution in State	Suggested Control Practices
	Seedling	Mature Plant					
		Stems	Leaves	Crown	Roots		
7. Spring black stem and leaf spot <i>Phoma medicaginis</i> var. <i>medicaginis</i>	X	X	X			Small, dark spots with irregular borders expanding with time (Plate 27). Petioles and lower stem are also affected (Plates 28 and 29). Severe disease may result in death of newly formed shoots. A disease of the lower canopy which may move upward during extended periods of cool, wet weather. SPBS is worse on spring growth. Occurs throughout the state.	Resistant varieties are not available. Harvest at early flower stage before disease becomes severe.
8. Stemphylium leaf spot <i>Stemphylium botryosum</i>			X			Light tan, well-defined lesions on upper leaves (Plate 32). Only observed in Goshen County following cool, wet weather.	No control recommended.
9. Summer black stem and leaf spot <i>Cercospora medicaginis</i>		X	X			Large, circular, gray-black spots on leaves (Plate 33). Dark reddish-brown to chocolate-colored lesions may occur on stems (Plate 34). Favored by warm, moist weather in summer or fall. Only observed in Goshen County.	No control recommended.
10. *Verticillium wilt <i>Verticillium albo-atrum</i>		X	X		X	Twisted leaves on upper stems which may be light green to tan to a tannish pink in color (Plates 1 and 2). Entire stems and plants eventually die (Plate 3). Leaf defoliation does not occur. When plants are removed and roots are cut, vascular tissue is a yellow-brown color. Attacks plants two to three years of age or older. Death usually occurs in the middle of the summer when plants are under drought stress. Verticillium wilt soon spreads to other plants in the field (Plate 4). Dead plants are usually replaced by weeds. Widespread throughout the state. Worse in eastern Wyoming from the Big Horn Mountains to the Nebraska border in sprinkler-irrigated fields.	Use resistant varieties.

Table 1. Diseases of alfalfa in Wyoming (continued).

Types of Diseases and Causes	Age and Plant Part Attacked					Symptoms and Distribution in State	Suggested Control Practices
	Seedling	Mature Plant					
		Stems	Leaves	Crown	Roots		
11. Yellow leaf blotch <i>Leptotrochila medicaginis</i>			X			Yellow to light brown to orange blotches occur on leaves (Plates 38 and 39). The disease is restricted in width by principal leaf veins. Petioles and stem may also be attacked. Severe defoliation may occur. Only a problem in dryland alfalfa production in the eastern portion of the state or in fields with limited irrigation.	Varieties having some yellow and/or variegated flowers may be tolerant.
<b>Bacterium</b>							
12. Bacterial stem blight <i>Pseudomonas syringae</i> pv. <i>syringae</i>		X	X			Infections at first appear water soaked with an amber color and later dry up and turn black or brown (Plates 40 and 41). Infected stems are short, spindly, and malformed or crooked (Plate 42). The disease occurs in fields at cooler, higher elevations following late spring frosts. This disease has been severe near Dayton, Wyoming.	Avoid excessive irrigation and harvest at early flower stage. Plant a winterhardy variety with fall dormancy rating of 2 to 3.
13. Bacterial wilt <i>Clavibacter michiganense</i> subsp. <i>insidiosum</i>		X	X		X	Diseased plants are scattered through the field and have yellow to light green foliage (Plate 19). Plants are usually stunted and leaves are small and cupped upward. Cross sections of tap roots show yellow to brown vascular discoloration (Plate 20). Diseased plants are prone to winterkill and usually die. May occur throughout the state. Infrequently seen since all certified varieties have good resistance.	All certified varieties are resistant.



Table 1. Diseases of alfalfa in Wyoming (continued).

Types of Diseases and Causes	Age and Plant Part Attacked					Symptoms and Distribution in State	Suggested Control Practices
	Seedling	Mature Plant					
		Stems	Leaves	Crown	Roots		
<b>Nematode</b>							
14. *Alfalfa stem nematode <i>Ditylenchus dipsaci</i>	X	X	X			Older plants show severe stunting with compacted crowns (Plate 5). Plants remain green but have limited growth and are prone to winterkill (Plate 6). When removed, roots are healthy but stem buds are swollen at the base, may be distorted, and many fail to emerge from the soil (Plates 7 and 8). Infected plants may have white shoots referred to as "white flagging." Worse in fields with heavy clay soils and furrow irrigation. In the western U.S., both the stem and <i>Chrysanthemum foliar</i> nematodes are found in diseased stem and bud tissue.	Plant a stem nematode-resistant variety. Stem nematode-resistant varieties appear to be resistant to the foliar nematode.
15. Northern root-knot nematode <i>Meloidogyne hapla</i>	X				X	Seedlings may be severely stunted and are prone to winterkill. Older plants may be stunted (Plate 17). Roots are branched excessively with many small galls (Plate 18). Worse in fields in eastern Wyoming having sandy loam soils.	Plant resistant varieties in fields known to be infested.
<b>Virus</b>							
16. Alfalfa mosaic virus <i>Alfamovirus</i> sp.		X	X			Leaves have yellow streaks between leaf veins or light green to yellow mottling and may be malformed (Plates 43 and 44). Plants are sometimes stunted and are more susceptible to winter injury. Occurs throughout the state.	Plant certified seed. Resistant varieties are not available.

\*For additional information see, "Other Related Publications" at the end of the bulletin. Other College of Agriculture publications which provide additional information on alfalfa diseases include Reference 2 (stem nematode), 4 (*Phytophthora* root rot), 5 (Brown root rot), and 8 (*Verticillium* wilt). Additional information on the majority of the diseases which occur in Wyoming is also provided in the *Alfalfa Analyst* (1) and in the *Compendium of Alfalfa Diseases* (6).

**Disease identification:** Contact a University of Wyoming agricultural extension educator if disease problems are observed in alfalfa that need to be diagnosed. He or she will provide information on how to collect and prepare a proper plant sample for submission to the university for diagnosis. Knowing which disease or diseases are present within a field is important in selecting a suitable variety when alfalfa is replanted after two or three years' rotation with another crop.

## Verticillium wilt



**Plate 1.** Early symptoms of Verticillium wilt (VW). Source: F.A. Gray.



**Plate 2.** Advanced symptoms of VW. Source: F.A. Gray.



**Plate 3.** Collapse of VW-diseased plant during the hot summer months. Source: F.A. Gray.



**Plate 4.** Field symptoms of VW showing multiple infected plants. Source: F.A. Gray.

## Alfalfa stem nematode



**Plate 5.** Severe stunting of plants parasitized by Alfalfa stem nematodes (ASN). Note adjacent healthy plants. Source: F.A. Gray.



**Plate 6.** Severe winterkill of ASN-parasitized plants. Source: F.A. Gray.



**Plate 7.** Alfalfa crown severely parasitized by ASN. Note swollen crown stem buds which fail to grow. Source: F.A. Gray.



**Plate 8.** Comparison of ASN-parasitized and healthy stems. Source: F.A. Gray.

## Brown root rot



**Plate 9.** Alfalfa field showing severe winterkill and stunting in a 3-year-old stand of alfalfa in the early spring due to Brown root rot (BRR). Source: F.A. Gray.



**Plate 10.** Close-up of field described in Plate 1 showing winterkill of an alfalfa plant due to BRR. Source: F.A. Gray.



**Plate 11.** Alfalfa plant removed from the 3-year-old stand shown in Plate 1 showing severe rot of the taproot caused by BRR. Note adjacent dead plant with root entirely rotted off. Source: F.A. Gray.



**Plate 12.** Severe BRR symptoms on 3-year-old plants. Source: F.A. Gray.

## Phytophthora root rot



**Plate 13.** Older field showing severe stand loss and stunted plants in furrow-irrigated field caused by PRR. Source: R.B. Hine.



**Plate 14.** Seedling blight phase of Phytophthora root rot (PRR). Note healthy and diseased plants. Source: F.A. Gray.



**Plate 15.** Severe root rot of a 6-month-old plant caused by PRR. Source: F.A. Gray.



**Plate 16.** Severe root rot of a 2-year-old plant caused by PRR. Rotted roots are usually reddish-brown in color. Source: F.A. Gray.

## Northern root-knot nematode



**Plate 17.** Severe stunting of potted alfalfa plant due to severe parasitism by Northern root-knot nematode (NRKN). Note healthy plant on the left. Source: F.A. Gray.



**Plate 18.** Root system of a 6-month-old alfalfa plant showing severe galling due to NRKN parasitism. Source: F.A. Gray.

## Bacterial wilt



**Plate 19.** Stunted and chlorotic plant infected by Bacterial wilt (BW) bacteria. Source: F.A. Gray.



**Plate 20.** Close-up of tap root showing vascular discoloration of water-conducting xylem vessels caused by BW. Source: F.A. Gray.

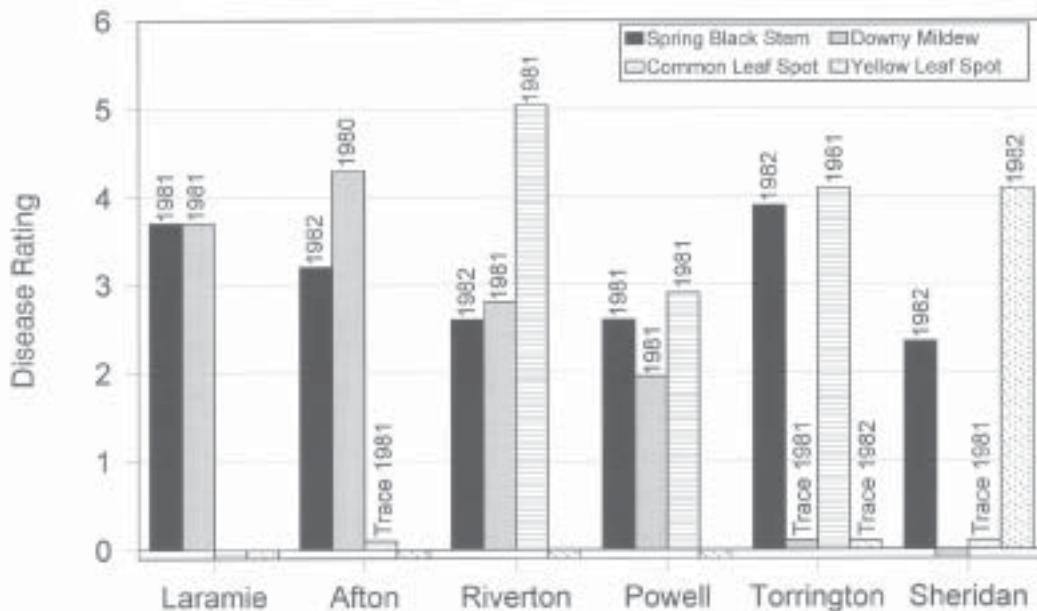
## Foliage Diseases

Several foliar (leaf and stem) diseases occur in Wyoming. The most prevalent are **Common leaf spot**, **Downy mildew**, and **Spring black stem and leaf spot** (Disease Numbers 3, 4, 7, Table 1). Less frequent foliar diseases include Anthracnose, Stemphylium leaf spot, and Summer black stem and leaf spot (Disease Numbers 1, 8, 9, Table 1). Of these diseases the most important are Common leaf spot and Spring black stem and leaf spot, which can reduce yield and forage value. Alfalfa plots containing standard check varieties were established at six locations in Wyoming and foliage diseases were assessed over a three-year period (1980-1982). Five locations were irrigated (Afton, Laramie, Powell, Riverton, and Torrington) while one (Sheridan) was grown under dryland conditions. Plots were visited twice yearly and foliage diseases identified and varieties rated for disease severity. Results are presented in Figure 1. Spring

black stem was the most prevalent disease at all six locations while Downy mildew and Common leaf spot occurred at three locations each. Yellow leaf blotch was identified at the dryland site only. Yellow leaf blotch (Disease Number 11, Table 1) appears to be the only foliage disease of importance in dryland alfalfa fields in Wyoming. This disease may cause severe leaf defoliation during certain years.

Bacterial stem blight (Disease Number 12, Table 1) occurs after spring frosts, resulting in severe damage to first-cut yields. This disease has been identified in irrigated fields on several occasions in Sheridan and Buffalo counties near the foothills of the Big Horn Mountains. It may occur elsewhere in the state at higher elevations.

Alfalfa mosaic virus is a seed-borne virus disease which becomes systemic throughout the plant (Disease Number 16, Table 1). Damage from this disease is considered minor.



**Figure 1.** Severity of four foliage diseases of alfalfa at six locations in Wyoming. Disease ratings were based on a scale of 1-5 in order of increasing disease severity (1 = no disease, 2 = slight, 3 = moderate, 4 = severe, 5 = very severe). Values are the highest disease rating given a cultivar at the site during the three-year period from 1980 through 1982. All test sites were irrigated except Sheridan, which was dryland.

## Common leaf spot



**Plate 21.** Leaves infected with Common leaf spot (CLS) fungus. Note small circular light brown to chocolate-colored spots on leaves and tissue chlorosis (yellowing). Source: F.A. Gray.



**Plate 22.** Severe leaf defoliation caused by CLS. Source: F.A. Gray.



## Downy mildew



**Plate 23.** Light green to yellow blotches on leaves caused by Downy mildew (DM) fungus. Source: F.A. Gray.



**Plate 24.** Close-up of DM-diseased leaves—upper leaf surface showing chlorosis. Source: F.A. Gray.



**Plate 25.** Close-up of DM-diseased leaves—lower leaf surface showing sporulation of the fungus. Source: F.A. Gray.



**Plate 26.** Systemic infection of upper portion of plant infected with DM fungus. Source: F.A. Gray.

**Spring black stem and leaf spot**



**Plate 27.** Leaf infection caused by Spring black stem and leaf spot (SPBS) fungus. Source: F.A. Gray.



**Plate 28.** Alfalfa plant severely diseased by SPBS fungus. Note black discoloration of lower stems and leaf defoliation. Source: F.A. Gray.



**Plate 29.** Close-up of diseased stem showing "black stem" symptom. Source: F.A. Gray.

## Anthracnose



**Plate 30.** Typical "Shepard's Crook" symptoms caused by Anthracnose (AN). Source: John E. Watkins.



**Plate 31.** Close-up of AN-infected stem showing "Shepard's Crook" symptom (right) and diamond-shaped, tan lesions with dark borders on lower stems. Source: *Alfalfa Analyst*.

### Stemphylium leaf spot



**Plate 32.** Stemphylium leaf spot (SLS) caused by the California biotype of SLS fungus. Source: F.A. Gray.

### Summer black stem and leaf spot



**Plate 33.** Leaf spot caused by Summer black stem and leaf spot (SBL) fungus. Note large dark brown to black spots on leaves. Source: F.A. Gray.

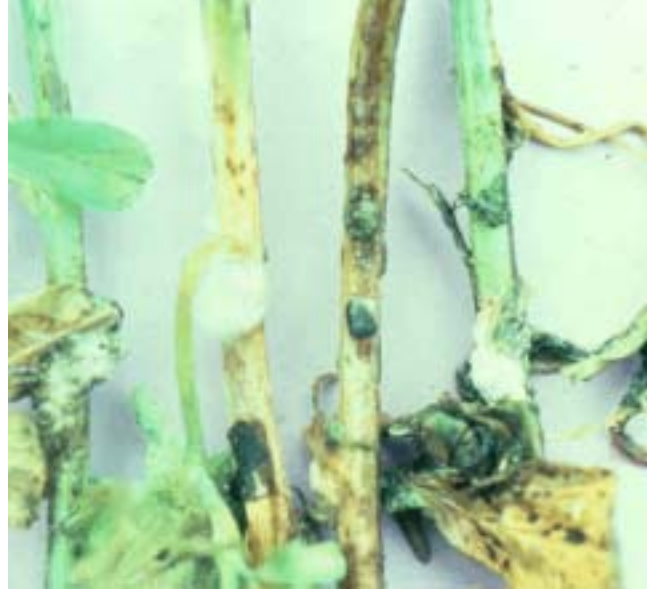


**Plate 34.** Leaf stem and symptoms caused by SBL fungus. Source: *Alfalfa Analyst*.

## Sclerotinia crown and stem rot



**Plate 35.** Dead plants caused by Sclerotinia crown and stem rot (SCSR). Source: L.H. Rhodes.



**Plate 36.** White fungal growth and black sclerotia on lower stems of alfalfa plants produced by SCSR fungus. Source: L.H. Rhodes.



**Plate 37.** Small orange mushrooms called apothecia which are produced from the sclerotia of SCSR fungus located at or near the soil surface. Ascospores are discharged from the apothecia and are wind-disseminated to other plants and nearby fields during the fall. Source: L.H. Rhodes.

## Yellow leaf blotch



**Plate 38.** Yellow leaf blotch (YLB) in a field of dryland alfalfa. Source: F.A. Gray.



**Plate 39.** Close-up of an alfalfa trifoliate leaf infected by YLB fungus. Source: F.A. Gray.

## Bacterial stem blight



**Plate 40.** Infection of the lower plant canopy by Bacterial stem blight (BSB) bacterium. Source: F.A. Gray.



**Plate 41.** Close-up of infected leaf showing water-soaked symptom caused by BSB bacterium. Source: F.A. Gray.



**Plate 42.** BSB symptoms showing amber color of diseased tissue and blackening and distortion of lower stems. Source: F.A. Gray.

## Alfalfa mosaic virus



**Plate 43.** Light green mottling of leaves caused by Alfalfa mosaic virus (AMV). Source: F.A. Gray.



**Plate 44.** Close-up of leaves infected by AMV showing light green to white streaks between leaf veins. Source: *Alfalfa Analyst*.



## DISEASE MANAGEMENT

Management practices of irrigated alfalfa, aimed at reducing loss from plant disease, are based on factors such as location in one of ten disease zones in the state, selection of an appropriate multiple disease-resistant variety, and use of other disease management practices including environment modification, crop rotation, irrigation, and fungicides.

### Disease Zones

To assist in the management of alfalfa diseases, a state/county map was developed with ten separate disease zones (Figure 2). Disease zones were designed on the basis of geography, historical laboratory, and field disease records. Diseases which have been identified in each zone are listed in order of importance (Table 2). Additional information on when or under what con-

ditions specific diseases may be expected to be severe is given under the “Comments” section. Knowledge of what diseases occur in your zone and which are most important is critical for selecting the best disease-resistant variety.

**Selecting Multiple Disease-Resistant Varieties.** Currently there are 252 certified varieties of alfalfa available for purchase in the U.S. (7). Of these, 167 with fall dormancy ratings of 2-4 can be adapted to the growing conditions in Wyoming. Names of these 167 varieties, marketing information, and disease ratings for the four major stand-decline diseases which occur in Wyoming are given in Table 3. Diseases include Verticillium wilt (VW), Phytophthora root rot (PRR), Stem nematode (SN) and Brown root rot (BRR). Alfalfa variety reaction to the Northern root-knot nematode (NRKN) is also provided for alfalfa grow-

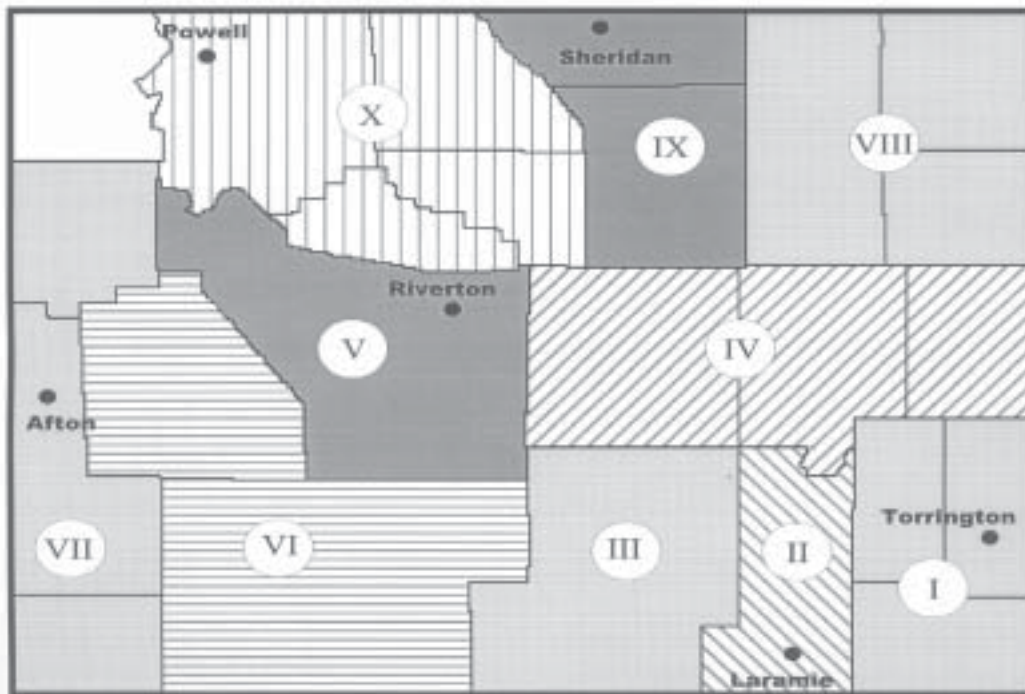


Figure 2. Ten Alfalfa Disease Zones in Wyoming and Foliage Disease Nursery Sites (•).

ers in eastern Wyoming. Disease ratings are explained in the footnotes at the bottom of each page. Varieties are also rated for fall dormancy (FD) on a scale of 1-10; 1 equals most fall dormant or winterhardy, and 10 equals least fall dormant or winterhardy. Currently there are no FD 1 varieties available or recommended for the U.S. In Wyoming, varieties should be chosen with FD ratings of 2-4, with 2s and 3s being grown at higher elevations and 3s and 4s grown at lower elevations. Varieties with FD ratings of 2 and 3 will go dormant sooner than varieties with higher FD ratings and will survive the harsh Wyoming winter.

When selecting a variety, emphasis should be placed primarily on the diseases which occur within a given zone that are known to cause stand and yield decline: Verticillium wilt, Stem nematode, Phytophthora root rot, and Brown root rot. Unfortunately, there are no certified varieties developed in the U.S. that have known resistance to Brown root rot. The U.S. variety Ranger (FD=3) and the Canadian variety Peace (FD=1) have shown field resistance to Brown root rot in Sweetwater County. To assist in the selection process, varieties with a “resistant” (R) rating or greater for Verticillium wilt, Phytophthora root rot, and Alfalfa stem nematode in Table 3 have a single asterisk while those with a “highly resistant” (HR) rating to all three diseases have double asterisks.

Information on resistance to foliage diseases is not readily available. Varieties with resistance to Common leaf spot and Downy mildew are available. Marketers and/or alfalfa seed companies can provide information on foliage disease resistance

for their varieties. Varieties with resistance to Bacterial stem blight have not been developed, and there are currently no varieties with resistance to Yellow leaf blotch. If it is not known what diseases are present, select a variety based on diseases given for the disease zone in Table 2.

For an example of variety selection, let's say a producer lives in Goshen County within Disease Zone I shown in Figure 2. Ten diseases have been identified in this zone and are listed in Table 2. Diseases are listed in order of importance. Verticillium wilt is the worst disease in Goshen County. Select a variety with an R or HR rating to Verticillium wilt, using an HR rating if the field will be irrigated by sprinkler. Care should be taken to consider soil type (sandy versus clay loam) and type of irrigation (furrow versus sprinkler) which may increase certain diseases. This is especially true for Stem nematode and Phytophthora root rot, which are generally more severe in fields with a high clay content (river bottom land) and Northern root-knot nematode, which is more severe in fields with a sandy loam soil. All will be worse under furrow irrigation. Several varieties are available with R or HR rating to all three of these diseases (Table 3). After selecting one or more varieties, check with a seed distributor or marketer on possible resistance to Common leaf spot.

Optimal yields and extended stand persistence should be obtained by selecting a variety with as high a level of disease resistance as possible. Check with a University of Wyoming agriculture extension educator to determine which of the varieties selected have been tested in Wyoming (3).

**Table 2.** Principal Alfalfa Diseases in the Ten Disease Zones in Wyoming.

<b>Disease Zone I (Goshen, Laramie, and Platte Counties)</b>	
<b>Diseases</b>	<b>Comments</b>
<ol style="list-style-type: none"> <li>1. <b>Verticillium wilt</b></li> <li>2. Common leaf spot</li> <li>3. Bacterial wilt</li> <li>4. Northern root-knot nematode</li> <li>5. Alfalfa stem nematode</li> <li>6. Phytophthora root rot</li> <li>7. Spring black stem and leaf spot</li> <li>8. Anthracnose</li> <li>9. Stemphylium leaf spot</li> <li>10. Summer black stem and leaf spot</li> </ol>	<p><b>Comments:</b> Verticillium wilt is considered to be the worst disease in this zone. Northern root-knot nematode is prevalent in fields having a sandy loam soil while Phytophthora root rot and Alfalfa stem nematode may occur in irrigated fields having a clay-loam soil. In these situations, emphasis should be placed on selecting a variety with resistance to these diseases as well. Considerable leaf loss may occur from foliage diseases during certain years, especially from Common leaf spot. Information on varietal resistance to CLS may be obtained from seed dealers and marketers.</p>
<b>Disease Zone II (Albany County)</b>	
<b>Diseases</b>	<b>Comments</b>
<ol style="list-style-type: none"> <li>1. <b>Alfalfa stem nematode</b></li> <li>2. <b>Brown root rot</b></li> <li>3. Phytophthora root rot</li> <li>4. Bacterial wilt</li> <li>5. Spring black stem and leaf spot</li> <li>6. Downy mildew</li> </ol>	<p>Alfalfa stem nematode and Brown root rot are considered to be the worst diseases in this zone. Verticillium wilt has not yet been reported in Zone II but may eventually occur.</p>
<b>Disease Zone III (Carbon County)</b>	
<b>Diseases</b>	<b>Comments</b>
<ol style="list-style-type: none"> <li>1. <b>Alfalfa stem nematode</b></li> <li>2. <b>Verticillium wilt</b></li> <li>3. Phytophthora root rot</li> <li>4. Spring black stem and leaf spot</li> <li>5. Brown root rot</li> <li>6. Downy mildew</li> <li>7. Bacterial wilt</li> </ol>	<p>Alfalfa stem nematode is considered to be the worst disease in this zone, followed by Verticillium wilt.</p>
<b>Disease Zone IV (Converse, Natrona, and Niobrara Counties)</b>	
<b>Diseases</b>	<b>Comments</b>
<ol style="list-style-type: none"> <li>1. <b>Verticillium wilt</b></li> <li>2. Alfalfa stem nematode</li> <li>3. Phytophthora root rot</li> <li>4. Bacterial wilt</li> <li>5. Common leaf spot</li> <li>6. Spring black stem and leaf spot</li> </ol>	<p>Verticillium wilt is considered to be the worst disease in this zone. Alfalfa stem nematode and Phytophthora root rot may also be severe in fields having heavy soils and furrow irrigation.</p>

**Table 2.** Principal Alfalfa Diseases in the Ten Disease Zones in Wyoming (continued).

<b>Disease Zone V (Fremont County)</b>	
<b>Diseases</b>	<b>Comments</b>
<ol style="list-style-type: none"> <li>1. <b>Alfalfa stem nematode</b></li> <li>2. <b>Phytophthora root rot</b></li> <li>3. <b>Verticillium wilt</b></li> <li>4. Bacterial wilt</li> <li>5. Common leaf spot</li> <li>6. Spring black stem and leaf spot</li> </ol>	Alfalfa stem nematode, Phytophthora root rot, and Verticillium wilt are considered to be the worst diseases in this zone.
<b>Disease Zone VI (Sublette and Sweetwater Counties)</b>	
<b>Diseases</b>	<b>Comments</b>
<ol style="list-style-type: none"> <li>1. <b>Brown root rot</b></li> <li>2. Phytophthora root rot</li> <li>3. Alfalfa stem nematode</li> <li>4. Verticillium wilt</li> <li>5. Bacterial wilt</li> <li>6. Spring black stem and leaf spot</li> <li>7. Downy mildew</li> </ol>	Brown root rot appears to be the major disease in this zone. However, growers are encouraged to plant varieties that have good resistance to the three stand-decline diseases (Verticillium wilt, Alfalfa stem nematode and Phytophthora root rot). The variety "Ranger" and the Canadian variety "Peace" have performed well in field trials near Farson in Sweetwater County where Brown root rot was present.
<b>Disease Zone VII (Lincoln, Teton, and Uinta Counties)</b>	
<b>Diseases</b>	<b>Comments</b>
<ol style="list-style-type: none"> <li>1. <b>Brown root rot</b></li> <li>2. Alfalfa stem nematode</li> <li>3. Verticillium wilt</li> <li>4. Spring black stem and leaf spot</li> <li>5. Bacterial wilt</li> <li>6. Downy mildew</li> </ol>	Brown root rot appears to be the most widespread disease in this zone. Verticillium wilt should be expected to be worse in fields under sprinkler irrigation and in wet years. Stem nematode has been identified in several fields having heavy clay soils with furrow irrigation. Although Phytophthora root rot has not yet been detected, it may occur in fields having heavy clay soils with furrow irrigation.
<b>Disease Zone VIII (Campbell, Crook, and Weston Counties)</b>	
<b>Diseases</b>	<b>Comments</b>
<ol style="list-style-type: none"> <li>1. Verticillium wilt</li> <li>2. Alfalfa stem nematode</li> <li>3. Phytophthora root rot</li> <li>4. Bacterial wilt</li> <li>5. Common leaf spot</li> </ol>	Little information is available on the incidence of diseases of irrigated alfalfa in this zone. However, to avoid accelerated stand decline, growers should plant only varieties that have a good level of resistance to Alfalfa stem nematode, Phytophthora root rot, and Verticillium wilt.

**Table 2.** Principal Alfalfa Diseases in the Ten Disease Zones in Wyoming (continued).

<b>Disease Zone IX (Johnson and Sheridan Counties)</b>	
<b>Diseases</b>	<b>Comments</b>
<ol style="list-style-type: none"> <li>1. <b>Verticillium wilt</b></li> <li>2. <b>Alfalfa stem nematode</b></li> <li>3. Bacterial stem blight</li> <li>4. Phytophthora root rot</li> <li>5. Bacterial wilt</li> <li>6. Spring black stem and leaf spot</li> </ol>	<p>Verticillium wilt is the most serious disease in this zone, particularly in fields close to the Big Horn Mountains and especially in sprinkler-irrigated fields. In fields where the soil clay content is high, Alfalfa stem nematode and Phytophthora root rot may also be severe, especially if fields are furrow irrigated. Varieties with resistance to Bacterial stem blight and spring black stem and leaf spot are not presently available.</p>
<b>Disease Zone X (Bighorn, Hot Springs, Park, and Washakie Counties)</b>	
<b>Diseases</b>	<b>Comments</b>
<ol style="list-style-type: none"> <li>1. <b>Alfalfa stem nematode</b></li> <li>2. <b>Phytophthora root rot</b></li> <li>3. <b>Verticillium wilt</b></li> <li>4. Brown root rot</li> <li>5. Bacterial wilt</li> <li>6. Common leaf spot</li> <li>7. Spring black stem and leaf spot</li> <li>8. Sclerotinia crown and stem rot</li> </ol>	<p>Alfalfa stem nematode, Phytophthora root rot, and Verticillium wilt are the worst diseases in this zone. The Alfalfa stem nematode and Phytophthora root rot are especially prevalent in fields having a high clay content and are most damaging in furrow-irrigated fields. Verticillium wilt should be expected to be worst in fields under sprinkler irrigation and in years when spring and fall weather conditions are cool and wet. Brown root rot has been identified only in two fields but may be more widespread.</p>

**NOTE:** Diseases shown in **bold** are the major diseases of concern in each disease zone.

**Table 3.** Disease Ratings of Certified Alfalfa Varieties with Fall Dormancy (FD) Ratings of 2 to 4.<sup>a</sup>

Variety	Contact for Marketing Information	FD <sup>b</sup>	Disease Rating <sup>c</sup>				
			VW	PRR	SN	BRR	NRKN
620	Garst Seed Co.	2	R	HR	LR	S	
ABT 205	Allied Seed, L.L.C.	2	R	HR		S	
Agate	Public	2		R		S	
Alfagraze	America's Alfalfa	2		LR	R	S	
Alpine II	Oasis Seed Cooperative	2	R	HR	MR	S	R
AmeriStand 201+Z	America's Alfalfa	2	HR	HR		S	
Arrowhead	Tri-West Seed	2	R	HR	MR	S	MR
Avalanche+Z	America's Alfalfa	2	HR	HR	MR	S	
Baker	Public	2				S	
Bounty	PGI Alfalfa, Inc./Producers Hybrids	2	R	HR		S	
Evolution	Mycogen Seeds	2	R	HR		S	
Laciator	Elk Mound Seed	2	HR	R		S	
Mariner	Allied Seed, L.L.C.	2	MR	HR		S	
Mariner II	Agway, Inc.	2	R	HR		S	
Sterling	Mycogen Seeds	2	R	HR		S	
UltraLac	Elk Mound Seed	2	HR	HR		S	
Vernal	Public	2				S	MR
Viking 1	Syngenta	2	HR	R		S	
WinterStar	Wensman Seed Co.	2	HR	HR	MR	S	
WL 232 HQ	W-L Research	2	HR	HR	MR	S	LR
Wrangler	Public	2	LR	HR		S	
120	Monsanto	3		R		S	
329*	L&H Seeds, Inc.	3	HR	HR	R	S	
360i	Greenway seed	3	HR	HR	R	S	
53H81	Pioneer Hi-Bred Int'l, Inc.	3	HR	R	R	S	
53Q60*	Pioneer Hi-Bred Int'l, Inc.	3	R	HR	R	S	MR
53V08**	Pioneer Hi-Bred Int'l, Inc.	3	HR	HR	HR	S	HR
53V63*	Pioneer Hi-Bred Int'l, Inc.	3	HR	HR	R	S	
6310*	Garst Seed Co.	3	R	HR	R	S	
645-II	Garst Seed Co.	3	HR	HR		S	
A30-06*	PGI Alfalfa, Inc.	3	HR	HR	R	S	
A395	PGI Alfalfa, Inc.	3	R	HR	MR	S	
ABT 350	Allied Seed, L.L.C.	3	HR	HR		S	
Abound*	Monsanto	3	HR	HR	R	S	
Arapaho*	Tri-West Seed	3	R	HR	R	S	HR
Baralfa 32IQ*	Barenbrug USA	3	R	HR	R	S	
Blazer XL*	Croplan Genetics	3	R	HR	R	S	
Champ*	Union Seed Co.	3	HR	R	R	S	
Class	Union Seed Co.	3	R	HR	MR	S	
Columbo	PGI Alfalfa, Inc./ Gooding Seed Co.	3	HR	R	MR	S	MR
Complete	Arrow Seed/Fontanelle Hybrids	3	HR	HR	MR	S	
Demand	AgriPro Seeds	3	HR	HR	MR	S	
DK124	Monsanto	3	HR	HR	MR	S	MR

\*Varieties with an "R" rating or greater for VW, PRR, and SN.

\*\* Varieties with "HR" rating for VW, PRR, and SN.

Disease ratings are as follows: HR = High resistance with 51% or more resistant plants, R = Resistant with 31-50% resistant plants, MR = Moderate resistance with 15-30% resistant plants, LR = Low resistance with 6-14% resistant plants,

Table 3. (continued).

Variety	Contact for Marketing Information	FD <sup>b</sup>	Disease Rating <sup>c</sup>				
			VW	PRR	SN	BRR	NRKN
DK127*	Monsanto	3	R	HR	R	S	R
DK134	Monsanto	3	HR	HR	LR	S	R
DK 37-20	Monsanto	3	HR	HR	S	S	
Duragreen	Renk Seed Co.	3	HR	HR		S	
Evergreen*	Syngenta	3	R	HR	R	S	
Extend	Spangler Seedtech, Inc.	3	R	HR		S	
Feast+EV	AgriPro Seeds	3	HR	HR		S	
Forecast 3001*	Dairyland Seeds	3	R	HR	R	S	R
FQ314*	Mycogen Seeds	3	HR	HR	R	S	
GH 766*	Golden Harvest Seeds, Inc.	3	R	HR	R	S	
GH 788	Golden Harvest Seeds, Inc.	3	R	HR	MR	S	
GoldLeaf*	Albert Lea Seed/ Gold Country Seed	3	R	HR	R	S	HR
Higuard	Renk Seed Co.	3	R	HR		S	
Hyland	Oasis Seed Cooperative	3	R	HR	MR	S	
Imperial	ABI Alfafa, Inc.	3	R	HR	LR	S	
Innovator+Z*	America's Alfalfa	3	HR	HR	R	S	
LeafMaster**	Union Seed Co.	3	HR	HR	HR	S	MR
Legendairy 2.0	Croplan Genetics	3	R	HR	MR	S	R
Legendairy YPQ	Croplan Genetics	3	R	R	MR	S	
MagnaGraze	Dairyland Seeds	3	R	HR	MR	S	LR
Magnum III-Wet	Dairyland Seeds	3	MR	R	MR	S	MR
Magnum V-Wet*	Dairyland Seeds	3	R	HR	R	S	HR
MainStay	AgVenture	3	R	HR		S	
Milk River*	R.J. Hunt Seed Co.	3	R	HR	R	S	
MP2000*	Croplan Genetics	3	R	HR	R	S	MR
Multiplier III	Mycogen Seeds	3	R	HR	MR	S	
Nemesis*	Renk Seed Co.	3	HR	HR	R	S	
Oneida VR	Public	3	HR	MR		S	
Paragon BR	Chemgro Seeds	3	R	HR		S	
Paramount	Chemgro Seeds	3	R	HR		S	
Perry	Public	3				S	
Pointer*	Bio Gene Seeds	3	HR	HR	R	S	
Prolific*	Doebler's Penn. Hybrids, Inc.	3	R	HR	R	S	HR
Rainier*	Syngenta	3	R	HR	R	S	R
Reliance	Agway, Inc./Growmark, Inc.	3	HR	HR	MR	S	
Rugged	Target Seed, LLC	3	HR	HR	MR	S	
Samurai	ABI Alfafa, Inc.	3	R	HR		S	
Somerset*	Syngenta	3	HR	HR	R	S	
Sparta*	Union Seed Co.	3	HR	MR	R	S	
Spirit	PGI Alfafa, Inc.	3	R	HR		S	MR
Stampede	Agway, Inc.	3	R	HR		S	
Starbuck	Spangler Seedtech, Inc.	3	R	HR	R	S	
Target II Plus*	Producers Hybrids/Wilken Seed	3	R	HR	R	S	R

\*Varieties with an "R" rating or greater for VW, PRR, and SN.

\*\* Varieties with "HR" rating for VW, PRR, and SN.

Disease ratings are as follows: HR = High resistance with 51% or more resistant plants, R = Resistant with 31-50% resistant plants, MR = Moderate resistance with 15-30% resistant plants, LR = Low resistance with 6-14% resistant plants,

Table 3. (continued).

Variety	Contact for Marketing Information	FD <sup>b</sup>	Disease Rating <sup>c</sup>				
			VW	PRR	SN	BRR	NRKN
Total+Z	America's Alfalfa	3	HR	HR	MR	S	
Triple Crown	Southern States Cooperative	3	R	HR	MR	S	
Vitro	Eureka Seeds, Inc.	3	HR	HR	R	S	
Wetland	Producers/Spangler Bros./ Wilken Seed	3	MR	HR		S	MR
Wintergreen*	Renk Seed Co.	3	HR	HR	R	S	
WinterKing*	Wensman Seed Co.	3	HR	HR	R	S	
WL 319HQ	W-L Research	3	HR	HR	MR	S	
WL 325 HQ*	W-L Research	3	R	HR	R	S	
Yielder	AgriPro Seeds	3	HR	HR		S	
330	Union Seed Co.	4	R	HR	MR	S	
4Traffic	Kaltenberg Seeds	4	HR	HR		S	
5454	Pioneer Hi-Bred Int'l, Inc.	4	MR	HR	MR	S	
54H55	Pioneer Hi-Bred Int'l, Inc.	4	HR	HR	HR	S	R
54H69*	Pioneer Hi-Bred Int'l, Inc.	4	R	HR	R	S	
54H91	Pioneer Hi-Bred Int'l, Inc.	4	HR	HR	MR	S	MR
54Q53**	Pioneer Hi-Bred Int'l, Inc.	4	HR	HR	HR	S	HR
54V54	Pioneer Hi-Bred Int'l, Inc.	4	HR	HR	LR	S	
630	Garst Seed Co.	4	MR	R	MR	S	
631*	Garst Seed Co.	4	R	HR	R	S	
6410	Garst Seed Co.	4	HR	HR		S	
6420*	Garst Seed Co.	4	R	HR	R	S	HR
ABT 400SCL	Allied Seed, L.L.C.	4	HR	HR		S	
Abundance	BioPlant Research/Ziller Seed Co.	4	MR	HR		S	
Accord	Chemgro Seeds/Union Seed Co.	4	R	HR	MR	S	MR
Affinity+Z*	America's Alfalfa	4	HR	HR	R	S	
Alliant*	Monsanto	4	R	HR	R	S	
AmeriGraze 401+Z*	America's Alfalfa	4	R	HR	R	S	
AmeriStand 403T	America's Alfalfa	4	HR	HR	MR	S	
AV3420	AgVenture	4	R	HR		S	
Award*	Monsanto	4	HR	HR	R	S	
Baralfa 42IQ	Barenbrug USA	4	HR	HR	MR	S	
BIGHORN*	Mycogen Seeds	4	R	HR	R	S	
Cimarron 3i*	Great Plains Research Company, Inc.	4	R	R	R	S	
Cimarron SR*	Great Plains Research Company, Inc.	4	HR	HR	R	S	
Crystal	PGI Alfalfa, Inc./ Wheatland Seed, Inc.	4	R	HR	MR	S	
Dakota	Great Plains Research Co., Inc.	4	MR	HR	MR	S	MR
Depend+EV	AgriPro Seeds	4	HR	HR	MR	S	
DG XTRA-3	UAP Seeds	4	R	HR	HR	S	R
DK 42-15	Monsanto	4	HR	HR	MR	S	
DK140	Monsanto	4	R	HR	MR	S	MR

\*Varieties with an "R" rating or greater for VW, PRR, and SN.

\*\* Varieties with "HR" rating for VW, PRR, and SN.

Disease ratings are as follows: HR = High resistance with 51% or more resistant plants, R = Resistant with 31-50% resistant plants, MR = Moderate resistance with 15-30% resistant plants, LR = Low resistance with 6-14% resistant plants,



Table 3. (continued).

Variety	Contact for Marketing Information	FD <sup>b</sup>	Disease Rating <sup>c</sup>				
			VW	PRR	SN	BRR	NRKN
Dual*	Great Plains Research Company, Inc.	4	R	R	R	S	
Dura 400	Farm Valley	4	HR	HR	MR	S	MR
Emperor	ABI Alfafa, Inc.	4	HR	HR		S	
Endurance	Derrick Seed Co.	4	HR	HR	R	S	MR
Enhancer	Arrow/Fontanelle/Sharp Bros.	4	R	HR		S	
Focus*	J.R. Simplot Co.	4	R	HR	HR	S	
Forecast 1001*	Dairyland Seeds	4	R	HR	R	S	HR
Geneva*	Syngenta	4	HR	HR	R	S	
GH 700*	Golden Harvest Seeds, Inc.	4	HR	HR	R	S	
GH 744	Golden Harvest Seeds, Inc.	4	HR	HR	R	S	
GH 750	Golden Harvest Seeds, Inc.	4	HR	HR	MR	S	
GH 757	Golden Harvest Seeds, Inc.	4	HR	HR	MR	S	MR
Gold Plus*	PGI Alfalfa, Inc./Top Farm Hybrids	4	R	HR	HR	S	
Goliath*	Allied Seed, L.L.C.	4	R	HR	HR	S	
Harvestar 812 HY*	Fielder's Choice Direct	4	R	HR	R	S	MR
Hayday*	Derrick Seed Co.	4	HR	R	HR	S	
HayGrazer*	Great Plains Research Company, Inc.	4	R	R	R	S	MR
HYTEST 340PLH	HYTEST Seeds	4	R	HR	MR	S	
HYTEST 410	HYTEST Seeds	4	HR	HR	R	S	
Intrigue*	Deer Creek Seed	4	HR	HR	R	S	
Jade II	NC+ Hybrids	4	R	HR			MR
Key	Great Plains Research Company, Inc.	4	HR	HR	MR	S	
Lightning II	Preferred Seed Co., Inc.	4	HR	HR		S	
LS 4500	Legend Seeds, Inc.	4	HR	HR		S	
Macon	Agway, Inc.	4	HR	HR		S	
Magnum III	Dairyland Seeds	4	MR	R	MR	S	
Magnum IV*	Dairyland Seeds	4	R	HR	R	S	MR
Magnum V*	Dairyland Seeds	4	R	HR	R	S	MR
Masterpiece*	J.R. Simplot Co.	4	R	HR	HR	S	R
Maximizer*	J.R. Simplot Co.	4	HR	HR	R	S	
Millennia*	Union Seed Co.	4	R	HR	HR	S	MR
Mountaineer*	Croplan Genetics	4	R	HR	HR	S	R
MultiQueen	L&H Seeds, Inc.	4	R	HR	MR	S	
Payday	Derrick Seed Co.	4	HR	HR		S	
Pegasus*	Agway, Inc./Southern States Coop.	4	HR	HR	R	S	
Persist	Doebler's Hybrids/ Kaltenberg Seeds	4	R	HR	MR	S	
Phabulous	Trelay Seed Co.	4	HR	HR	MR	S	
Phirst*	Doebler's Penn. Hybrids, Inc.	4	R	HR	R	S	HR
Plumas*	Eureka Seeds, Inc.	4	R	HR	HR	S	MR

\*Varieties with an "R" rating or greater for VW, PRR, and SN.

\*\* Varieties with "HR" rating for VW, PRR, and SN.

Disease ratings are as follows: HR = High resistance with 51% or more resistant plants, R = Resistant with 31-50% resistant plants, MR = Moderate resistance with 15-30% resistant plants, LR = Low resistance with 6-14% resistant plants,

Table 3. (continued).

Variety	Contact for Marketing Information	FD <sup>b</sup>	Disease Rating <sup>c</sup>				
			VW	PRR	SN	BRR	NRKN
Pristine*	Doebler's Penn. Hybrids, Inc.	4	R	HR	R	S	MR
ProGro	PGI Alfalfa, Inc.	4	R	HR		S	
Proleaf	PGI Alfalfa, Inc./Oasis Seed Coop.	4	R	HR	MR	S	LR
Radiant*	Ampac Seed Co.	4	HR	HR	R	S	
Rebel	Target Seeds, L.L.C.	4	HR	HR		S	
Rebound 4.2	Croplan Genetics	4	HR	HR	MR	S	
Reno*	Syngenta	4	R	HR	HR	S	MR
Reward	Drussel/J.R. Simplot/ PGI Alfalfa/Producers	4	R	HR	MR	S	
Reward II*	PGI Alfalfa, Inc.	4	R	HR	R	S	HR
Riley	Public	4	LR			S	
Rocket	Croplan Genetics/Growmark, Inc.	4	R	HR	MR	S	
Root 66	Trelay Seed Co.	4	HR	HR		S	
Select*	Union Seed Co.	4	R	HR	HR	S	R
Spur	Allied Seed, L.L.C./ Wheatland Seed	4	R	HR	MR	S	
ST-9429	Eureka Seeds, Inc.	4	R	HR	R	S	
Stellar	Chemgro Seeds	4	HR	HR		S	
Trialfalon	Chemgro Seeds	4	R	HR		S	
Vernema	Public	4	MR	LR	HR	S	
WinterGold	L&H Seeds/Reuk Seed/ Tri-West Seed	4	HR	R		S	
W215	Public	4	HR	HR	MR	S	MR
WL 326 GZ*	W-L Research	4	HR	HR	R	S	
WL 327*	W-L Research	4	R	HR	R	S	
WL 338SR	W-L Research	4	R	HR		S	
WL 342*	W-L Research	4	HR	HR	R	S	

\*Varieties with an "R" rating or greater for VW, PRR, and SN.

\*\* Varieties with "HR" rating for VW, PRR, and SN.

Disease ratings are as follows: HR = High resistance with 51% or more resistant plants, R = Resistant with 31-50% resistant plants, MR = Moderate resistance with 15-30% resistant plants, LR = Low resistance with 6-14% resistant plants, S = Susceptible with 0-5% resistant plants, and (blank) = No resistance reported, assumed to be susceptible.

#### FOOTNOTES

<sup>a</sup> Information on certified alfalfa varieties and their disease ratings was obtained from *Fall Dormancy and Pest Resistant Ratings for Alfalfa Varieties*, 2002/2003 Edition, available from the Alfalfa Council, 1201 NW Briarcliff Parkway, Suite 200, Kansas City, MO 64116 ([www.alfalfa.org](http://www.alfalfa.org)) (7). Addresses and phone numbers of marketers of each variety are provided in this publication.

<sup>b</sup> Fall dormancy (FD) ratings are made on a scale of 1 to 10 (1 = most winter dormant, 10 = least winter dormant). No FD = 1 varieties are available in the U.S. Varieties with a rating of 2 to 4 are considered suitable for most Wyoming conditions. Generally, varieties with dormancy ratings of 2 and 3 should be planted at higher elevations (above 6,000 feet), and those with dormancy ratings of 3 or 4 should be planted at lower elevations.

<sup>c</sup> Disease ratings are based on standardized tests. Only certified alfalfa varieties are assigned disease ratings by the National Alfalfa Certification Review Board. Information on reaction to Common leaf spot and Downy mildew are not provided by the Alfalfa Council but may be available from seed marketers or dealers. Currently there are no U.S. certified varieties available with resistance to Spring black stem or Brown root rot.

## **Other Disease Management Practices**

### ***Environment Modification***

Plant disease severity is usually increased if air and soil temperatures are favorable and prolonged periods of optimum moisture occur. Phytophthora root rot and Alfalfa stem nematode both require water-saturated soils for plant infection to occur. Stem nematode infects newly forming stem buds which emerge from the crown just below the soil surface. Phytophthora infects roots several inches below the soil surface. As previously mentioned, the diseases are worse in flood-irrigated fields with heavy soils and in low areas of fields, both of which retain moisture longer. Managing irrigation to avoid prolonged periods of soil saturation and waiting until regrowth is 6 to 8 inches high before irrigating will reduce the severity of both diseases. Leveling fields prior to establishing alfalfa, particularly fields with heavy soil, will also aid in managing Phytophthora root rot and Stem nematode. Air-borne spores of Verticillium wilt can infect plants through recently cut stems. This usually occurs immediately after swathing, especially if a field receives rain or is sprinkle irrigated. A higher incidence of Verticillium wilt occurs in sprinkler-irrigated fields. Swathing fields when foliage is completely dry and waiting for two to three days before irrigating should reduce the spread and damage related to Verticillium wilt.

### ***Crop Rotation***

Rotating alfalfa fields with small grains or corn for two to five years will reduce pathogen populations and increase the performance of the disease-resistant variety of alfalfa when alfalfa is replanted. The longer the rotation, the better the control. Some diseases are reduced more than others de-

pending on the presence of long-term survival structures. Crop rotation, although helpful, has less effect on the incidence of Brown root rot and Phytophthora root rot than other diseases present in Wyoming.

### ***Fungicides***

Seedling diseases may occur in fields when environmental conditions are optimum for their development (cool, wet soils). This is particularly true in fields where Phytophthora root rot is present. Severe seedling disease in alfalfa has been observed in Wyoming in new seedlings in fields with a history of growing alfalfa and of having a high clay content (25 percent or greater) and in old alfalfa stands that are interseeded, a practice that is not recommended. In both cases disease damage is usually worse during cool, wet periods which tend to occur in the spring. In new seedlings the use of the fungicide metalaxyl as a seed or soil treatment, even with resistant varieties, should reduce seedling loss when environmental conditions are favorable for disease development. Metalaxyl seed treatment will also provide protection for seedling alfalfa from downy mildew.

Although sulfur and copper fungicides can be used to reduce foliar diseases in alfalfa, few are applied in Wyoming. However, under severe foliage disease pressure, particularly when Spring black stem and/or Common leaf spot are present, either of these fungicides should reduce leaf defoliation. Application of fungicides should be made before a disease becomes severe and should be applied with a ground sprayer if possible. Bi-weekly applications of copper hydroxide provided moderate control of Spring black stem in southeastern Wyoming and significantly increased forage yield at the first harvest.

## INTEGRATED DISEASE MANAGEMENT

### Managing Old Stands

- Avoid excessive irrigation, especially in fields with high clay soils, since this will increase Alfalfa stem nematode and Phytophthora root rot. Fields that are flood irrigated are more likely to be over irrigated than those that are sprinkler irrigated. Remember, Verticillium wilt is usually worse in sprinkler-irrigated fields.
- After harvesting fields that are flood irrigated, allow 6 to 8 inches of regrowth before irrigating. This practice will reduce infection by Stem nematode of young stem buds which initiate below the soil surface.
- Fields known to have Verticillium wilt should be harvested last. Before reusing a swather, pressure wash it to remove all alfalfa plant material and allow it to dry.
- Interseeding alfalfa into old stands which are declining from disease is not recommended. This is particularly true if Alfalfa stem nematode and/or Phytophthora root rot are present since seedlings are particularly susceptible to both diseases.

### Establishing New Stands

- Choose a certified variety with as high a level of resistance as possible to diseases present in the disease zone. Plant varieties with a fall dormancy (FD) rating of 2 or 3 at higher elevations and 3 or 4 at lower elevations. Use all information available on variety yield performance from university tests conducted in Wyoming (3), neighboring states, and by other growers to further aid in the selection of the best variety.
- Plant new stands in fields after a two to three-year rotation with other crops. This will allow time for a reduction of most alfalfa disease pathogens.
- If fields are furrow irrigated, level them prior to seeding to allow for good drainage.
- If Phytophthora is known to be present, select a variety with an HR rating. Metalaxyl, applied as a seed or soil treatment, should provide added protection of alfalfa seedlings during establishment.
- Add Rhizobium inoculant in the seed box prior to planting if seeds are not already pre-inoculated. This will allow for the formation of root nodules for a maximum fixation of atmospheric nitrogen.

## OTHER RELATED PUBLICATIONS

1. ***Alfalfa Analyst***. Revised edition. Alfalfa Council. 10920 Ambassador Drive, Suite 302, Kansas City, MO 61453. Published yearly.
2. ***Alfalfa Stem Nematode Biology and Management***. 1993. University of Wyoming, Agricultural Experiment Station Bulletin No. B-761R.
3. ***Guide for Selecting Alfalfa Varieties for Irrigated Stands in Wyoming***. 1995. University of Wyoming, Agricultural Experiment Station Bulletin No. B-1009.
4. ***Biology and Management of Phytophthora Root Rot of Alfalfa***. 1996. University of Wyoming, Agricultural Experiment Station Bulletin No. B-791R.
5. ***Brown Root Rot of Alfalfa***. 1999. University of Wyoming, Department of Plant Sciences, College of Agriculture. Plant Science Timely Information Series. Bulletin No. 1.
6. ***Compendium of Alfalfa Diseases***. 1990. The American Phytopathological Society, 3340 Pilot Knob Road, St. Paul, MN 55121. 2nd Edition.
7. ***Fall Dormancy and Pest Resistance Ratings for Alfalfa Varieties 2001/2002 Edition***. Alfalfa Council. 10920 Ambassador Drive, Suite 302, Kansas City, MO 61453. Published yearly.
8. ***Verticillium Wilt of Alfalfa***. 2001. University of Wyoming, Agricultural Experiment Station Bulletin No. B-1022R.
9. ***World Distribution and Historical Development***. 1988. Chp. 2. Alfalfa and Alfalfa Improvement. Agronomy Series No. 29.