

Assessment of Foliage Diseases of Alfalfa in Wyoming

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ABSTRACT

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Disease nurseries of standard cultivars were used to assess foliage diseases of alfalfa. One nursery was placed in each of six (five irrigated and one dryland) geographically diverse growing areas in Wyoming and monitored over a 3-yr period. Common leaf spot, downy mildew, spring black stem, and yellow leaf blotch were detected. The first three diseases occurred at all irrigated sites except Laramie, where common leaf spot was not found. Yellow leaf blotch occurred at a measurable level only at the dryland site and appears to be the major disease of dryland alfalfa in Wyoming. Diseases detected in nurseries were the same as those found in surrounding commercial fields.

More than 10 diseases have been reported to attack foliage of alfalfa (*Medicago sativa*) in the United States (2). Spring black stem, caused by *Phoma medicaginis* Malbr. & Roum. var. *medicaginis* Boerema, and powdery mildew, caused by *Erysiphe polygoni* DC. ex St. Amans, are the only foliage diseases previously reported from Wyoming (4), and no extensive survey has ever been made of the major production areas.

The objective of this study was to identify foliage diseases of alfalfa and estimate the severity of each in the major irrigated and dryland production areas in the state. A preliminary report of this study has been made (3).

MATERIALS AND METHODS

Disease nurseries were established at five locations in the spring of 1980 and at one location in 1981. Sites were located on University of Wyoming research stations except at Riverton, where the nursery was located on a cooperator's farm. Each site represented a geographically distinct growing area (Fig. 1). All sites were irrigated except at Sheridan, where the crop was grown under dryland conditions. Elevation (m), precipitation (cm), temperature (C), frost-free days, and number of harvests per year for the Laramie, Afton, Riverton, Powell, Torrington, and Sheridan sites were 2,195, 25, 5.2, 101, 2; 1,870, 57, 4, 39, 1; 1,561, 19, 7.1, 118, 2; 1,332, 16, 7.9, 148, 2-3; 1,249, 34, 9.2, 128, 2-3; and 1,158, 34, 7.2, 97, 1, respectively. Values for precipitation, temperature,

and frost-free days are 4-yr (1978 through 1981) means. Each nursery consisted of 11 cultivars planted in a randomized complete block design with four replicates. Individual plots were 1.1 m wide (six rows spaced 15 cm apart) × 4.6 m long. Plots were seeded at a rate of 11.2 kg pure live seed per hectare. EPTC (Eptom) was incorporated preplant at a rate of 2.34 L a.i./ha. When available, standard resistant and susceptible cultivars were used (1).

Seed of standard cultivars was obtained from J. H. Elgin, Jr., USDA, ARS, Field Crops Laboratory, Beltsville, MD 20705. The disease, causal organism, and appropriate susceptible (S) and resistant (R) cultivar were: anthracnose (*Colletotrichum trifolii* Bain), Saranac (S) and Arc (R); bacterial wilt (*Corynebacterium insidiosum* (McCull.) H. L. Jens.), Narragansett (S) (not used

due to insufficient supply of seed) and Vernal (R); common leaf spot (*Pseudopeiziza medicaginis* (Lib.) Sacc.), Ranger (S) and Ramsey (R); downy mildew (*Peronospora trifoliorum* de Bary), Kanza (S) and Saranac (R); *Leptosphaerulina* leaf spot (*Leptosphaerulina briosiana* (Poll.) Graham & Luttrell), Ranger (S), no resistant cultivar available; northern root-knot nematode (*Meloidogyne hapla* Chitwood), Lahontan (S) and Nevada Synthetic XX (R); *Phytophthora* root rot (*Phytophthora megasperma* Drechs. f. sp. *medicaginis* Kuan & Erwin), Saranac (S) and Agate (R); rust (*Uromyces striatus* Schroet.), Ranger (S) and MSA-CW3AN3 (R) (seed was not available in sufficient quantity and Cherokee was substituted); spring black stem (*Phoma medicaginis* var. *medicaginis*), Lahontan (S) and Ramsey (R); summer black stem (*Cercospora medicaginis* Ell. & Ev.), Lahontan (S), no resistant cultivar available; and yellow leaf blotch (*Leptotrochila medicaginis* (Fckl.) Schuepp), Ranger (S) and Teton (R).

Because of the distance between the six sites (2,092 km) and the limited number of harvests (avg. two per year), nurseries were visited only once in 1980 (year of establishment) and twice in 1981 and 1982. Sites were visited when alfalfa was in the early to full-bloom stage. It was

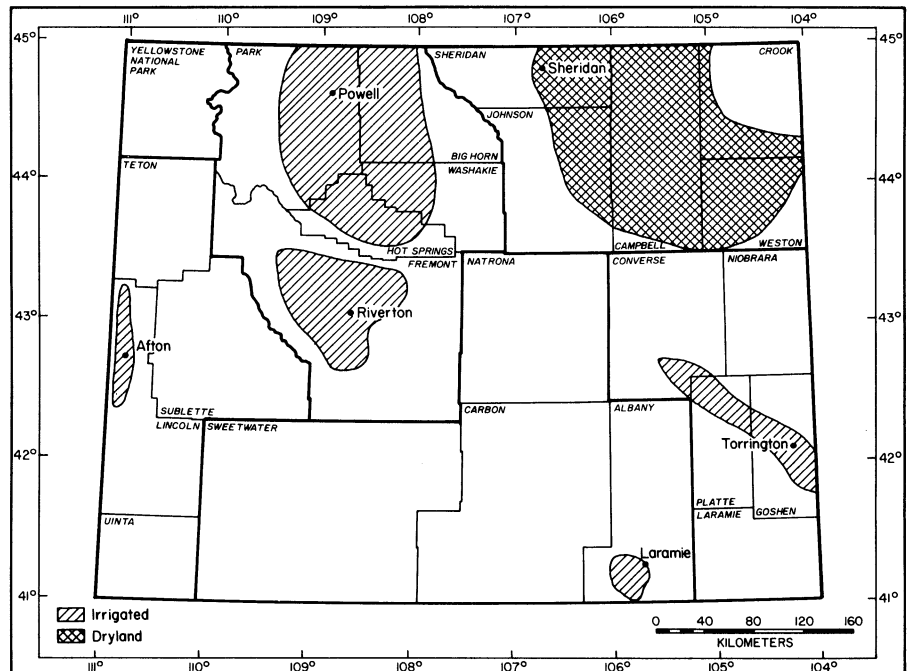


Fig. 1. Locations of six alfalfa foliage disease nurseries in Wyoming and associated alfalfa production areas.

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assumed that the foliage diseases would accumulate on the plant during the growing period and be present at harvest. Disease was rated for severity on a scale of 1-5, where 1 = no disease, 2 = slight, 3 = moderate, 4 = severe, and 5 = very severe, as suggested by Barnes et al (1). To obtain additional accuracy in rating, increments of 0.5 were used. Observations of the lower and upper canopy were made before assigning ratings. Dunnett's LSD (one-sided comparison) was used to compare the mean disease ratings of all cultivars with the standard susceptible cultivars.

Plots were cut and forage removed at full bloom and yields were not recorded. Commercial fields were examined in each of the six growing areas and diseases identified concurrently with site visitations. Diseases were identified from plant symptoms and fungal structures described by Graham et al (2).

RESULTS AND DISCUSSION

Common leaf spot, downy mildew, and spring black stem were the major foliage diseases of irrigated alfalfa except at Laramie, where common leaf spot was not detected. Yellow leaf blotch was the only major disease that occurred in dryland alfalfa. Powdery mildew, which had been reported previously, was not found.

The presence of fruiting structures for *Phoma medicaginis* differed from published reports. According to Graham et al (2), under natural conditions, the asexual pycnidial stage of *P. medicaginis* rarely forms on lesions during the growing season but occurs in abundance on overwintered stems and leaves. In this study, mature pycnidia were frequently

observed on leaf lesions before the first harvest as well as on overwintered stems and leaves.

The highest level of disease severity and the year each occurred for the four diseases at the six sites are shown in Figure 2. Spring black stem occurred at all six locations and appeared to be the most versatile of the four diseases. Downy mildew was found at all irrigated sites but not at the dryland site. Common leaf spot was detected at four of five irrigated sites as well as at the one dryland site. Yellow leaf blotch was present at one of the five irrigated sites and at the dryland site.

Although the study was not designed to

make statistical comparisons between climate and disease severity, several generalizations could be drawn. Severity of downy mildew increased as the mean temperature at the site decreased. As the mean temperature at the site increased, the severity of common leaf spot also increased. There appeared to be no relationship between severity of downy mildew and common leaf spot with the mean precipitation at the site.

Observed reactions of the 11 cultivars to the four foliage diseases are given in Table 1. Disease ratings are for site and year, where and when the disease was most severe. Mean ratings for spring black stem were not significantly

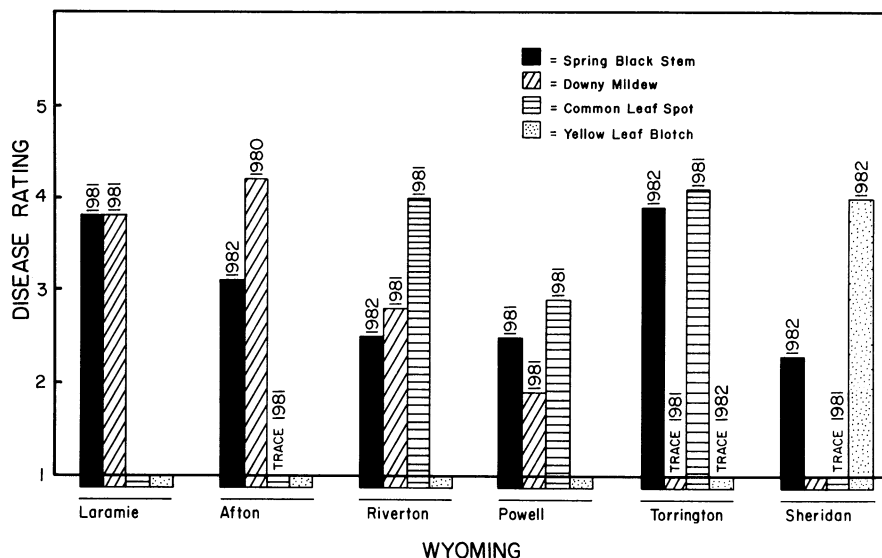


Fig. 2. Severity of four foliage diseases of alfalfa at six locations in Wyoming. A disease nursery containing 11 standard alfalfa cultivars was planted at each location. All locations were irrigated except Sheridan, which was dryland. Disease rating was based on a scale of 1-5 in order of increasing disease severity. Values are the highest disease rating given a cultivar at the site during the 3-yr period 1980 through 1982 and are the mean of four replicates.

Table 1. Reaction of 11 standard alfalfa cultivars to four foliage diseases

Cultivar ^a	Foliage disease						
	Spring black stem	Downy mildew	Common leaf spot	Yellow leaf blotch			
	Mean disease severity ^b	Cultivar	Mean disease severity	Cultivar	Mean disease severity	Cultivar	Mean disease severity
Ramsey (R)	3.0 ^c	Saranac (R)	2.0	Nevada Synthetic XX	2.8	Nevada Synthetic XX	2.8
Arc	3.3	Cherokee	2.3	Arc	2.8	Vernal	3.0
Cherokee	3.3	Agate	2.5	Kanza	2.9	Arc	3.0
Vernal	3.4	Arc	2.7	Teton	3.0	Saranac	3.1
Saranac	3.5	Kanza (S)	2.7	Cherokee	3.4	Cherokee	3.1
Ranger	3.5	Vernal	2.7	Vernal	3.4	Kanza	3.3
Teton	3.6	Lahontan	3.0	Saranac	3.5	Teton (R)	3.3
Nevada Synthetic XX	3.6	Ramsey	3.0	Ranger (S)	3.5	Agate	3.5
Agate	3.8	Teton	3.0	Ramsey (R)	3.9	Ramsey	3.9
Lahontan (S)	3.8	Ranger	3.3	Agate	4.0	Lahontan	4.0
Kanza	3.9	Nevada Synthetic XX	4.2	Lahontan	4.1	Ranger (S)	4.0
LSD (Dunnet)							
0.05	NS ^d		1.12		NS		0.73
0.01	NS		1.43		NS		0.93
C.V. (%)	15.5		21.7		24.2		12.1

^aCultivars are standards for measuring disease resistance in alfalfa. (R) = resistant and (S) = susceptible.

^bDiseases were rated on a scale of 1-5, where 1 = no disease, 2 = slight, 3 = moderate, 4 = severe, and 5 = very severe.

^cValues are the mean disease severity ratings of four replicates from the site and year the disease was most severe. The disease, site, and year are: spring black stem, Torrington, 1982; downy mildew, Afton, 1980; common leaf spot, Torrington, 1981; yellow leaf blotch, Sheridan, 1982.

^dNS = F value not significant at P = 0.05.

different ($P = 0.05$) and comparisons between the standard susceptible and the other cultivars could not be made. Only Kanza, however, had a higher disease rating than the susceptible Lahontan (3.9 and 3.8, respectively). Nevada Synthetic XX had significantly more downy mildew (rating of 4.2) than the susceptible Kanza (rating of 2.7). Common leaf spot ratings were also not significantly different ($P = 0.05$). Lahontan had the highest rating (4.1) compared with the susceptible Ranger (rating of 3.5). Ranger, the yellow leaf blotch-susceptible check, had the highest disease rating (4) of the 11 cultivars.

If the presently designated cultivars (1) are to be used to assess foliage diseases in the field, Nevada Synthetic XX, the

designated resistant cultivar for the northern root-knot nematode, should be considered as a replacement for Kanza as the susceptible cultivar for downy mildew. Lahontan appeared to be an effective susceptible cultivar for spring black stem and Ranger, for yellow leaf blotch.

Diseases detected in nurseries were the same as those found in surrounding commercial fields of each of the six areas. Although plants were not removed from plots and inspected, other diseases were not detected and stands did not appear to have declined during the 3-yr period.

Disease nurseries containing standard cultivars were an effective aid in detecting and determining distribution of foliage diseases of alfalfa in Wyoming.

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