Alfalfa diseases

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Figure 1. Growth of the downy mildew fungus on lower surface (above) and upper surface (below) of two alfalfa leaflets and a leaf. Healthy leaflet at left in each series.
Figure 2. Cercospora leafspot on Lahontan alfalfa leaflets and a leaf.

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ALFALFA DISEASES

By HOWARD W. JOHNSON

Diseases are a limiting factor in establishing and maintaining profitable stands of alfalfa in Mississippi. In addition to shortening the productive life of stands, disease organisms that attack the leaves, stems, and roots reduce the yield and quality of the alfalfa hay. No single disease appears to be of outstanding importance in this region. However, the cumulative effect of the numerous disease-producing organisms that attack alfalfa creates a serious problem for alfalfa growers. This situation is intensified by the short period of dormancy, or semi-dormancy, of the crop during the brief, mild winters, since this permits the pathogens to remain active during much of the year.

To assist technical workers and alfalfa growers in Mississippi in identifying and controlling the diseases, this publication describes and illustrates the symptoms of the more prevalent ones, gives some information on their distribution and seasonal occurrence, and discusses control recommendations briefly. The diseases are classified according to the principal plant part attacked, although no disease is restricted strictly to one plant part in its effects. Damping-off and the vascular wilts, which are characterized by general wilting and death of the entire plant, are discussed under root and crown diseases.

LEAF DISEASES

The leaves of alfalfa are attacked by a series of pathogens throughout the season, ranging from the pepper spot fungus in late winter and early spring to the rust fungus in late fall. These parasites cause premature defoliation, thus reducing the size and quality of the hay crops at each cutting.

Pepper Spot

Pepper spot, caused by the fungus Leptosphaerulina briosiana (Poll.) Graham and Luttrell, appears on the alfalfa plants in late February or March in the South. Symptoms are hundreds of small black flecks on both surfaces of the leaf blades and on the petioles. This gives the plants the appearance of having been well peppered and has lead to the common name “pepper spot.” The spots enlarge slightly as they mature and the infected leaves turn yellow and fall from the plant. Perithecia develop on the dead overwintered leaves in late winter and the ascospores discharged from these serve as inoculum. The disease is widespread on alfalfa.

Downy Mildew

Downy mildew (Peronospora trifoliorum D By.) may cause considerable damage to the first cutting of hay and weaken the plants. Symptoms are light-green leaves at the apex of the stem and a grayish-white, mold-like growth on both surfaces of the leaves (Figure 1). The fungus lives from year to year as oospores which form in the dead tissues and as perennial mycelium in the crown buds. The disease is widely distributed on alfalfa.

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Ascochyta Leafspot

Ascochyta leafspot (Ascochyta imperfecta Pk.) develops during the cold, wet conditions of early spring. Dark spots that are variable in size and shape develop on the leaflets, which finally turn yellow and fall off. The first cutting may suffer considerable damage. The same fungus causes dark brown to black lesions up to 3 inches in length on stems and petioles. This stage of the disease is known as spring black stem. The organism overwinters in dead alfalfa stems and the spores produced in pycnidia on the stem lesions in the spring serve as inoculum. The disease occurs in all alfalfa-growing regions of the United States.

Cercospora Leafspot

Cercospora leafspot (Cercospora medicaginis Ell. & Ev.) develops during warm, moist weather and reduces the value of the summer cuttings of alfalfa. The spots are roughly circular and dark brown to black in color (Figure 2). They appear ashy-gray during moist weather, when spores are produced in abundance on the lesions. The same fungus causes dark, elongated lesions on the stems and petioles (Figure 3). This stage of the disease is known as summer black stem. Severely diseased leaves fall off. The lesions are conspicuous when the plants are in flower and cutting in an early bloom stage should save some of the leaves from falling.

Stemphylium Leafspot

Stemphylium leafspot (Stemphylium botryosum Wallr.) develops on the summer growth of alfalfa during warm, moist periods. The lesions on the leaflets show concentric zones of light and dark brown tissues. Older lesions may appear sooty from the abundant production of large, muriform spores. This leafspot appears to be less prevalent than those discussed above but is responsible for some defoliation in many years.

Common Leafspot

Common leafspot (Pseudopeziza medicaginis (Lib.) Sacc.) occurs as small, circular brown spots on the leaflets. They usually do not discolor the surrounding leaf tissues. When the spots are fully developed (about 1/16 inch in diameter), a small dark-brown to black raised disk develops on each. The spores that spread the disease are produced in the raised disks that are called apothecia. This disease is of minor economic importance in Mississippi in comparison to the other alfalfa leafspots discussed above.

Alfalfa Rust

Rust, caused by the fungus Uromyces striatus Schroet. var. medicaginis (Pass.) Arth., occurs on leaves of alfalfa plants during summer and fall. The disease is characterized by reddish-brown masses

Figure 3. Cercospora lesions on stems and petioles (left) and on a shoot tip (right) of Lahontan alfalfa.
of fungus spores that rupture the epidermis of the leaves (Figure 4). When abundant, the rust pustules cause the leaves to shrivel and fall, thus reducing the size and quality of the hay crop. The alfalfa stems may become infected when the interval between cuttings is lengthened, as in making a seed crop. The disease is widely distributed in the southern United States.

Alfalfa Mosaic

Mosaic is a virus disease characterized by yellow and green mottling of the alfalfa leaves. It becomes evident during the cool weather of spring and fall when the stunted, mottled plants may be observed scattered throughout the alfalfa fields. During the warmer summer months, very few symptoms can be seen. The pea aphid spreads the virus from plant to plant in the field. The disease is not of major importance in Mississippi, but its widespread occurrence and the stunting of growth that occurs cause some loss in yield each season.

STEM DISEASES

The stems of alfalfa plants are attacked by a series of pathogens throughout the season, starting with stem rot in early spring. Some of these organisms cause leafspots as well as stem lesions and some are able to invade and rot the crown of the plant as well as the stem. The losses they cause are probably greater than those caused by the foliar parasites discussed above.
Stem Rot

Stem rot (Sclerotinia trifoliorum Eriks.) is evident in early spring as a rotting of the stem bases and crown branches near the soil line. The fungus causes death of these tissues and wilting of the tops. Abundant fungus mycelium develops on the surface of the lesions and this appears as a white, cottony mat during moist weather. Black, hard, irregularly-shaped sclerotia are formed in the white mat (Figure 5). These remain dormant during the summer and germinate in the cool, moist weather of autumn by producing vegetative mycelium or small, stalked, saucer-shaped apothecia which emerge to the soil surface (Figure 6). The apothecia produce large numbers of ascospores that are discharg-ed into the air and reproduce the fungus. The disease is widely distributed and is of economic importance in some seasons.

Southern Anthracnose

Southern anthracnose (Colletotrichum trifolii Bain) occurs in early summer as lesions on the alfalfa stems and petioles (Figure 7). Spore-producing bodies (acervuli) develop in the bleached centers of the stem lesions. Spores from these cause new infections. The girdling of the stems and petioles causes wilting and browning of the tissues above the girdled areas. This reduces the size and quality of the hay crop. Under favorable conditions for disease development, the fungus may invade the crown and the taproot, thus weakening or killing the plants. The
disease is common in the Southern States on both alfalfa and clovers.

Sclerotial Blight

Sclerotial blight (Sclerotium rolfsii Sacc.) is evident in the summer when the fungus attacks the stem bases and crown branches of the alfalfa plants. The plant tissues above bleach to a tan color and die (Figure 8). The small, light-brown, spherical sclerotia of the fungus are found on the stems and crown and on mycelial mats that form on the soil surface. They look like mustard seeds. The fungus is widespread in silty and sandy soils in the Southern States and it is on these soil types that the more severe losses occur. The common name “southern blight” is applied to this disease, since it occurs primarily in the South. The fungus attacks a wide range of host plants, including grasses, and causes loss of stand.

Rhizoctonia Stem Canker

Rhizoctonia stem canker (Rhizoctonia solani Kuehn) has been observed on alfalfa at Stoneville, Miss., following flood irrigation (Figure 9). The cankered areas are predominately tan in color. The attacked tissues are killed causing the

Figure 6. Germinating sclerotia of the stem rot fungus dug from field soil in December.

Figure 7. Anthracnose lesions with bleached centers and dark margins on alfalfa stems.
leaves and stem tips to yellow, wilt, and die. The fungus is widespread in southern soils where it attacks cotton and many other plants. On alfalfa, it causes greater losses as a seedling pathogen and as a crown and root-rotting parasite than it does by canker ing stems. The fungus forms sclerotia that differ from those of the sclerotial blight fungus by being irregular in shape and darker brown in color. They serve to perpetuate the fungus in the soil.

ROOT AND CROWN DISEASES

Numerous pathogens attack the root and crown of the alfalfa plant throughout its life, starting with damping-off of young seedlings and ending with rotting of the crown and taproot of mature plants in old stands. The losses caused thus range from those due to difficulty in establishing a stand to those due to premature thinning of old stands. In either case, the grower is faced with the cost of reseeding the field.

Damping-Off

Alfalfa seedlings may be attacked by several soil fungi, if environmental con-
Conditions are favorable for infection after seeding. These cause death of the seedlings, either before or after emergence from the soil. A species of Phytophthora isolated from a diseased alfalfa seedling at Stoneville, Miss., caused a severe killing of alfalfa seedlings when seeds were planted in steamed soil artificially infested with the fungus (Figure 10). A Pythium sp. caused a similar amount of killing when tested in this way. These fungi are sometimes called water molds, since the resting spores germinate in wet soil by forming free-swimming zoospores, or vegetative mycelium, that spread the causal organism from plant to plant. The disease is, therefore, more destructive in a wet, clay soil with poor internal drainage. Other fungi that cause damping-off of alfalfa seedlings are R. solani and Fusarium spp.

Root and Crown Rot

Several soil-inhabiting fungi cause rotting of the root and crown of mature alfalfa plants, particularly when the plants have been weakened by some type of winter injury or by summer drought. Tap roots of some dying plants of Delta alfalfa dug at Stoneville, Miss., were found to bear black, stromatic masses of fungus tissue externally (Figure 11). When such crowns and tap roots were split open

Figure 9, Lesions on stems of Buffalo alfalfa (left) caused by Rhizoctonia solani following flood irrigation of a field at Stoneville, Miss., and a healthy stem (right).
longitudinally, a dark-gray to black internal discoloration was observed (Figure 12). When pieces of the blackened tissue were placed in moist chambers, beaked spore-producing structure (pycnidia) developed and a species of Botryodiplobdia was isolated in pure culture. The fungus caused a slow, black rot of the tap root of alfalfa seedlings when mycelium was inserted in a slit. The fungus appeared to be a slow-acting parasite. Two other fungi have been isolated from alfalfa roots similarly discolored; i.e., Mycoleptodiscus terrestris (Gerd.) Ostazeski and Sclerotium bataticola Taub. As mentioned above, the fungus causing stem canker (R. solani) also attacks and rots the crown and roots of alfalfa. The diseased tissues in the latter case are dry and dark-brown in color.

**Bacterial Wilt**

Bacterial wilt, caused by the bacterium Corynebacterium insidiosum (Mc. Cull.) H. L. Jens., is seen frequently in the lower poorly-drained portions of fields in northeastern Arkansas and the Missouri bootheel. It is of infrequent occurrence in the Yazoo-Mississippi Delta area.

The first symptom is stunting of the infected plants, noticeable usually as a slow recovery after cutting. Diseased plants have an increased number of smaller diameter stems and the leaflets are smaller and thicker. Yellowing of the leaves soon occurs, followed by wilting during periods of water stress. The tap root shows a yellow-brown discoloration of the outer woody tissue when the bark is peeled off or the root is cut through. In advanced stages, all parts of the wood show a brown color. The bacteria are present in the water-conducting tubes of the roots and stems and are released by the breakdown of the infected tissues. They are distributed in the soil water and gain entrance to new plants through wounds. Plants usually die 5 to 8 months after infection. Resistant varieties are the only practical means of control.

**Fusarium Wilt**

Fusarium wilt, caused by the fungus Fusarium oxysporum Schlect. f. medicaginis (Weimer) Snyder et Hansen, was reported as an alfalfa disease for the first time in 1927 from Mississippi, where

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Figure 10. Thin stands of Delta (left) and Buffalo (right) alfalfas obtained when seeds planted in pots of steamed soil infested with a Phytophthora sp. The pots in the center (front and rear) show the thick stands obtained when the two varieties were seeded at the same rate in non-infested steamed soil.
Figure 11. Black, stromatic masses of fungus tissue on the exterior of alfalfa roots from which a Botryodiplodia sp. was isolated (right) and the root from a healthy plant (left).

it was recognized as a factor in thinning out stands. The first symptom of the disease is a rapid wilting of the stems on one side of the plant during the hot part of the day, or when the soil becomes too dry. This is followed by bleaching of the affected tissues and the development of a pink color in the basal leaves. The woody cylinder of the root and crown branches shows a browning of the vascular bundles. The vascular discoloration is restricted to one side of the root, when only one stem or a part of the top is killed. Fusarium wilt resembles bacterial wilt to some extent. There are no resistant varieties.

DISEASE CONTROL

Direct control measures, such as spraying and dusting, have only limited application in controlling alfalfa diseases. In most cases, control must be sought through the development of disease-resistant varieties by selection or hybridization. Two such varieties adapted to the Lower Mississippi Valley States are Cherokee and Delta.

Cherokee was developed jointly by the North Carolina Agricultural Experiment Station and the Crops Research Division of the U.S. Department of Agriculture. Released in 1961, it is the end product of 7 cycles of recurrent selection and is tolerant to leafhopper yellowing, alfalfa rust, crown and stem rots, and certain leaf spot diseases. It has yielded well in tests in the Lower Mississippi Valley States.

Delta was developed jointly by the Mississippi Agricultural Experiment Station and the Crops Research Division of the U.S. Department of Agriculture. Releas-
ed in 1965, it is the end product of work started in 1948 when outstanding plants were selected from old alfalfa fields in the Yazoo-Mississippi Delta. Maternal line selection was employed in developing the variety from plants of Dakota 12 alfalfa selected from an old field on the Brown farm near Leland, Miss. Dakota 12 had been grown continuously on this farm for more than 20 years and through 3 or 4 seed generations. Delta persists well on heavy clay soils due to its tolerance to root and crown rots. Like Cherokee, it has yielded well in tests in the Lower Mississippi Valley States.

Where bacterial wilt has become a problem in fields in the region, a wilt-resistant variety such as Buffalo or Cody should be grown.

Modifying cultural practices to control diseases has only limited application in the case of alfalfa. Cutting early before leaf drop increases the yield and quality of the hay crop in the case of some leaf spots. Treating the alfalfa seeds with a fungicide before planting has been tested at Stoneville, Miss., and failed to improve the stand obtained or to increase the yield of hay.