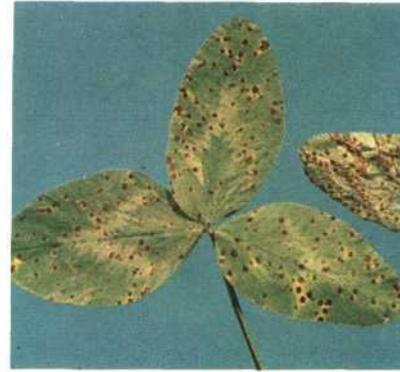


CLOVER DISEASES I



1. Stemphylium leaf spot or Target spot



2. Common or Pseudopeziza leaf spot



3. Sooty blotch leaf spot



4. Cercospora leaf spot



5. Bacterial blight or bacterial leaf spot



6. Powdery mildew



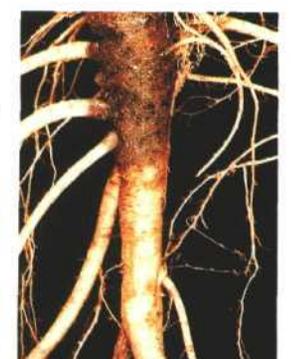
7. Red clover vein mosaic



8. Alfalfa mosaic



9. Northern anthracnose



10. Root rot



11. Root and crown rots



12. Fusarium root rot or Common root rot



13. Internal breakdown



14. Dodder

CLOVER DISEASES I

- 1. Stemphylium leaf spot or Target spot**, caused by the fungi *Stemphylium sarcinaeforme* and *S. botryosum*, is a common warm, wet weather disease of red clover. Losses are greatest in dense stands in late summer and autumn. Small dark brown spots on the leaflets later enlarge and develop into oval-to-round, target-like spots with alternate light and dark brown rings. Entire older leaves become wrinkled and dark brown with a sooty appearance. Such leaves usually remain attached to the plant. Elongated, sunken brown lesions with light centers may occasionally form on the stems, petioles and pods. The causal fungi overwinter in infected plant residue.
- 2. Common or Pseudopeziza leaf spot** of red clover, caused by the fungus *Pseudopeziza trifolii*, is closely related to those causing common leaf spot and yellow leaf blotch of alfalfa. Infections are widespread during cool, wet weather. Very small, angular to round, dark spots—olive to reddish-brown, purple or black—develop on both leaf surfaces. Occasionally, small elongated dark streaks may occur on the petioles. Severely infected leaves may become yellow. The fungus overwinters in crop debris.
- 3. Sooty blotch**, sometimes called black blotch, is a widely distributed disease of red clover caused by the fungus *Cymadothea trifolii*. Olive-green dots appear on the lower leaf surface, enlarge, become thicker and darker, and eventually resemble velvety, black, elevated cushions. In the fall, the black areas have a shiny surface. If infection is severe, the entire leaf turns yellow-to-brown, dies, and drops early. The fungus overwinters in plant residue.
- 4. Cercospora leaf spot**, sometimes called summer black stem, is a widespread disease of red clover during warm, moist weather in summer and early autumn. It is caused by the fungus *Cercospora zebrina*. Leaf spots are angular, deep brown and more or less delimited by the veins. Older spots may develop ash-gray centers. Sunken, dark brown lesions on the stems and petioles may enlarge and merge to form extensive dark areas on the stems. The disease is spread by planting infected seed. The fungus also overwinters in crop debris.
- 5. Bacterial blight or bacterial leaf spot**, caused by *Pseudomonas syringae*, is a minor disease of red clover. During cool, wet weather at any time during the growing season angular, dark brown-to-black blotches may form on the leaflets, petioles, stipules, stems, and flower pedicels. During wet weather, a milky-white bacterial exudate may form on diseased areas. The exudate dries to form a thin, crusty film that shines in the light. Infected leaves may become tattered and torn as the wind tears away the dead areas. The bacterium overwinters in infected residue and is spread by splashing rain and equipment.
- 6. Powdery mildew** occurs wherever red clover is grown. It is most severe during long periods of dry weather when nights are cool and days are warm. The disease, caused by the fungus *Erysiphe polygoni*, can reduce both yield and hay quality, especially late in the growing season. A dusty, white to pale gray mildew grows in patches on the leaves. Infected leaves may turn yellow and wither prematurely. The mildew fungus overwinters as black specks (cleistothecia) scattered on diseased plant residue. It is spread by air currents.
- 7. Red clover vein mosaic** is caused by a virus and is transmitted from plant-to-plant by the pea aphid (*Macrosiphum pisi*) and other aphids as they feed. The first symptom is a faint yellowing of the leaf veins. The chlorosis gradually intensifies until the veins and adjacent tissue may become a whitish-yellow. Symptoms are most conspicuous in young leaves during cool weather. Symptoms become "masked" or disappear during hot weather. Yields are reduced and affected plants are weakened and more susceptible to root rot fungi, winter injury, and drought. In time, clover stands thus become thin and unproductive.
- 8. Alfalfa mosaic** is a virus-caused disease, transmitted from diseased alfalfa, red clover, or other legume plants to healthy plants by various species of aphids. A systemic light and dark green or yellow mottling is the most common symptom. Other symptoms may include vein yellowing, leaf crinkling and distortion, and yellow streaks or blotches on and between the veins. Legumes, especially garden peas and beans, growing near clover or alfalfa fields, commonly serve as reservoirs for mosaic viruses—alfalfa, red clover vein, bean yellow, and pea common. The viruses overwinter in a wide range of perennial host plants.
- 9. Northern anthracnose**, caused by the fungus *Kabatiella caulivora*, is a serious disease of red clover in cool, wet weather. Elongated, dark brown to black, sunken, girdling lesions on the leaf petioles and stems cause the shoot tips and flower heads to droop (like a shepherd's-crook) or collapse. The lesions are later light colored with dark margins. The leaves on affected plants wilt, appear scorched as if by fire, become very brittle, and hang on for some time. The anthracnose fungus may be carried on or within the seed; it also overwinters in plant residue.
- 10. Root rot** may be caused by one of several soil-borne fungi. Fungus growth is found in the crown-root area and within ruptured or otherwise injured tissues. Irregular, brown-to-black decayed areas may develop on the whole crown and upper taproot may disintegrate. Root rot is most conspicuous in early spring. This disease complex causes a greater loss than all other diseases of red clover combined.
- 11. Root and crown rots** affect all types of clover. This disease, caused by a complex of soil-borne fungi, acting singly or together, may cause a 50 percent loss of red clover plants during the first year. Diseased plants are generally yellow to bleached, stunted, and often wilt during hot dry weather. Such plants gradually decline in vigor; finally wither and die.
- 12. Fusarium root rot or Common root rot**, is caused by several species of the fungus *Fusarium*. Like other crown and root rots, infection usually occurs to plants weakened by winter injury, prolonged drought, low or unbalanced fertility, insect or nematode injury, improper management, mechanical injuries, or other diseases. Affected plants appear unthrifty, stunted, yellowish and wilt during hot, dry weather. Plants may be killed at any stage of growth but stand loss is greatest during the second year. A spongy or soft, light brown, reddish brown, or dark brown internal and external decay develops in the larger roots. The smaller feeder roots are also decayed, and appear "pruned off." The causal fungi are common soil inhabitants and are generally distributed wherever red clover is grown.
- 13. Internal breakdown** is common in winter-injured crown and root tissue of red clover and other clovers. Crown buds are damaged or killed. This tissue is later invaded by fungi and bacteria resulting in serious crown and root rot losses. The control is to grow well-adapted species and varieties in a well-drained, fertile soil. **Avoid:** overgrazing and overcutting in the fall, rank growth, and excessive rates of fertilizer (especially nitrogen).
- 14. Dodder** (*Cuscuta* spp.) is a slender, twining, parasitic vine that occurs in tangled, yellowish-orange patches that "pull down" clover plants. Dodder infects a wide range of crop plants, being especially common and damaging to clovers and alfalfa. Dodder seed is very difficult to separate from clover seed.

For chemical control suggestions, a listing of resistant varieties, and other control measures, consult the Extension Plant Pathologist at your land-grant university, or your county extension office.

CLOVER DISEASES II



1. *Cercospora* leaf spot



2. Common or *Pseudopeziza* leaf spot



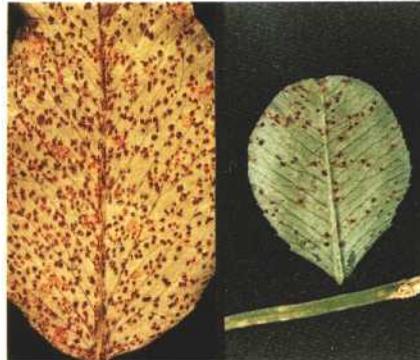
3. *Ascochyta* leaf spot



4. Slime molds



5. *Stagonospora* leaf spot



6. Rust



7. *Pseudoplea* leaf spot



8. Sooty blotch or black blotch



9. Northern anthracnose or clover scorch



10. Peanut mottle



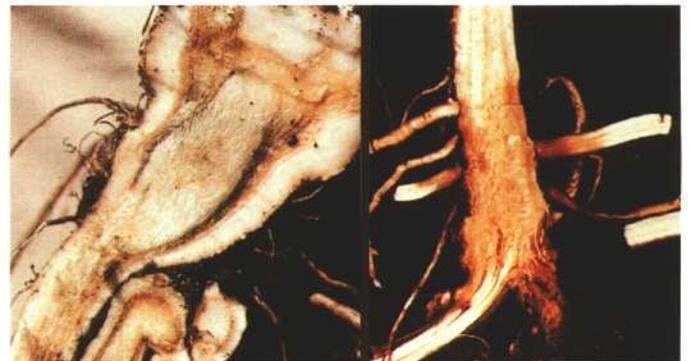
11. Clover phyllody



12. Root rot of sweetclover



13. *Fusarium* wilt of sweetclover



14. Crown rot of sweetclover

CLOVER DISEASES II

1. **Cercospora leaf spot**, more commonly called summer black stem, is a widespread, warm, moist weather disease caused by the fungus *Cercospora zebrina*. Damage to white (Ladino) clover pastures may be severe during late summer in the southern half of the United States. On Ladino the lesions are angular to rectangular, dark brown, and more or less delimited by the veins. The centers of older fruiting lesions is gray-to-black. Lesions on the stems, petioles, and flower heads are reddish brown to dark brown and somewhat sunken. Severely infected seed are shriveled and discolored. The fungus also persists overwinter in old stems.

2. **Common or Pseudopeziza leaf spot** of Ladino clover is caused by *Pseudopeziza trifolii*, a fungus that attacks other perennial clovers as well. Infections occur during cool wet weather. Small, round to angular, dark reddish brown-to-black spots with lighter centers develop on both leaf surfaces. Severe infection may cause the leaves to drop early reducing both the yield and hay quality. The fungus overwinters in crop debris.

3. **Ascochyta leaf spot**, also called spring black stem, is caused by the fungus *Phoma trifolii*. Dark brown-to-black spots, irregular in size and shape, develop on or along the leaf veins and on the petioles following cold wet weather. Some lesions may develop gray-tan centers. Black, enlarging lesions form on the stems. Young shoots may be girdled and killed. Leaf and stem infections together may result in defoliation. The causal fungus is seed-borne and also overwinters in crop residue.

4. **Slime molds** cause an unimportant disease. During wet weather one of a number of these primitive, soil-borne fungi creep (flow) up and over low-lying vegetation or other objects and soon form their powdery, bluish, white-to creamy yellow, or black fruiting bodies. Some of the more common species include *Physarum cinereum*, *Mucilago spongiosa*, and *Fuligo septica*. Although unsightly, these fungi do no harm except to keep light off the foliage in areas up to about three feet in diameter. The growth can easily be rubbed off to expose the healthy or yellowed clover tissue underneath. Slime molds usually disappear following a good rain.

5. **Stagonospora leaf spot** is widely distributed on white clover, including Ladino, in warm, wet areas. The causal fungus, *Stagonospora meliloti* (perfect stage *Leptosphaeria pratensis*), also infects red and alsike clovers, alfalfa, sweetclover, and other legumes. Small, round to irregular spots with a pale, almost white center and light to dark brown border form in the leaves. Occasionally, older lesions develop faint concentric zones. Dark specks in older spots are fungus fruiting bodies (pycnidia). The fungus overwinters in infected crop residue.

6. **Rust** occurs wherever clovers are grown but usually causes little damage. The rust fungus, *Uromyces trifolii*, has several stages. The aecial stage appears in spring as swollen, light yellow to orange-yellow pustules on the stems, petioles, and leaves that may cause distortion. Later in the season, small, oval, reddish brown, dusty pustules (uredial stage) develop on the leaves, petioles, and stems. When severe, especially in late summer and autumn, rusted leaves may turn yellow and drop early. Late in the season the pustules become dark brown to black (telial stage). The rust fungus overwinters on clovers in the southern United States and is blown northward each summer on southerly winds.

7. **Pseudopeziza leaf spot**, also called pepper spot, is widely distributed on clovers, being most common during cool, moist weather. Numerous, small, sunken black spots form on both leaf surfaces and on petioles. Later, the spots turn gray with a reddish brown margin. The disease may cause leaf curling and yellowing or browning on white and Ladino clovers. Like other leaf diseases, Pseudopeziza leaf spot is found mostly on lower leaves under dense growth. The causal fungus, *Pseudopeziza trifolii*, overwinters in crop residue.

8. **Sooty blotch or black blotch** occurs generally on white, alsike, and other clovers. Small, angular to irregular, velvety or shiny black spots,

most numerous on the lower leaf surface, may cause infected leaves to wither, become brown, and drop prematurely. The sooty blotch fungus, *Cymadothea trifolii*, overseasons in crop residue.

9. **Northern anthracnose or clover scorch** is caused by the fungus *Kabatella caulivora*. It is most common on red, crimson, alsike, and white sweet clovers during cool, wet weather in the northern half of the United States. Elongated, sunken, medium brown-to-black, girdling lesions, with light centers, form on the stems and petioles and result in a dark brown scorching of the foliage. Leaves and flower heads commonly droop to form a "shepherd's-crook." The anthracnose fungus is seed-borne and also overwinters in plant residue.

10. **Peanut mottle** is a viral disease that occurs in about the southern half of the United States. Numerous legumes, including clovers, peanuts, and soybeans are infected. Diseased plants are often stunted, lack vigor, and are more susceptible to winter injury, drought, and other diseases. Leaves on affected plants are irregularly mottled with a yellow and light and dark green mosaic. Yellowish patches and line patterns commonly develop. The virus is spread by various aphids as they feed and is seed-borne at a low frequency. Peanut mottle cannot be distinguished from other viral diseases in the field. Laboratory tests are required for positive identification.

11. **Clover phyllody**, caused by one or more mycoplasma-like organisms, and transmitted by several genera and species of leafhoppers is a striking but unimportant disease. The most characteristic symptom is a transformation of certain flower parts (calyx lobes) into miniature, simple or trifoliate leaf-like structures borne on the ends of pedicel-like organs. Individual flower pedicels, calyx lobes, and ovaries may be three times their normal size. The other flower parts (keel and wings) remain white but dwarfed or even absent. New shoot growth is prolific, spindly, and stunted with smaller than normal yellowish leaves. In later stages the leaves may be slightly deformed and darker green.

12. **Root rot of sweetclover** may be caused by numerous soil-borne fungi including species of *Phytophthora*. The tops of affected plants are somewhat stunted, later wilt, become bleached-to-brown, and die from a spongy, soft, yellowish brown-to-black rot of the crown and taproot following excessive rain or overirrigation. The disease is most common and severe in poorly drained soils subject to periodic flooding or saturation. *Phytophthora* and other root-rotting fungi enter all types of wounds.

13. **Fusarium wilt of sweetclover** results in a wilting, yellowing and browning, and slow dying of scattered plants in irregularly shaped areas of fields that are infested with the *Fusarium oxysporum* fungus. The water-conducting tissue (xylem) inside the stems, crown, and roots shows a dark discoloration due to fungus invasion and root-tissue response. The fungus may survive in soil or plant refuse for five years or more in the absence of sweetclover and other host plants.

14. **Crown rot of sweetclover** may be caused by several soil-borne fungi that persist in soil and crop debris. Infections occur through a wide variety of wounds. Plants weakened by adverse temperatures, insect or nematode feeding, virus diseases, drought, improper management, other mechanical injuries, low soil fertility, or other unfavorable soil conditions are most susceptible. Crown rot can be found in most plants over a year old. Decayed tissue varies in color from yellowish brown to dark brown or black, often interspersed with healthy tissue. Crown rot often progresses slowly over several years, gradually killing plants and thinning out the stand. The relative prevalence and severity of these crown- and root-rotting fungi vary greatly with the type and variety of clover, age of the plant, season of the year, locality, soil type, and management conditions.

For cultural control suggestions, and a listing of resistant varieties, consult the Extension Plant Pathologist at your land-grant university, or your county extension office.