

Alfalfa Analyst

Third edition

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Alfalfa is a vigorous and productive crop. Like all crops, however, alfalfa is subject to stand and yield loss from disease, insect injury, nutrient deficiencies, and other environmental stresses. Prompt and accurate diagnosis of a problem can allow early treatment to modify or correct the situation before yields are seriously affected or stands are lost.

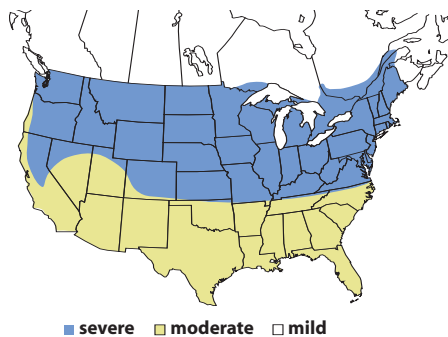
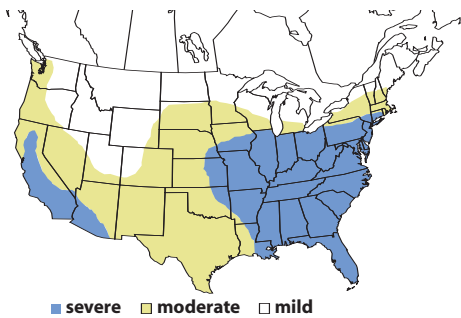
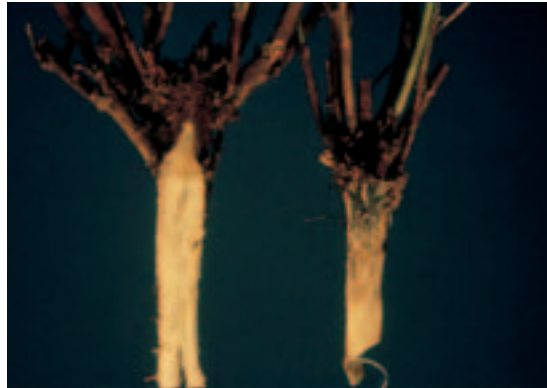
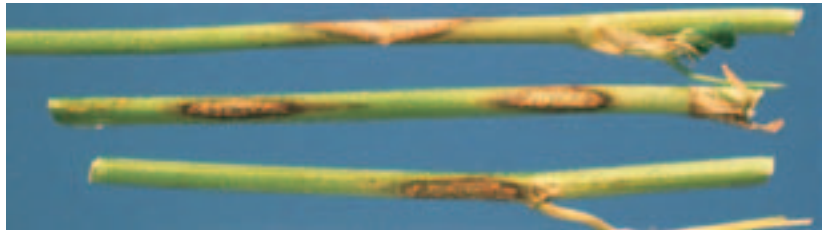
The purpose of the *Alfalfa Analyst* is to provide an identification guide to some of the more important alfalfa yield and stand limiters. Please use it to help identify any alfalfa problems you may have. Then secure specific up-to-date management recommendations from your local Extension service.



diseases

Anthracnose

Diamond-shaped tan lesions with dark borders appear near the base of the stems. Centers of the lesions contain small black bodies that produce spores. The fungus may girdle and kill stems, crown buds, and eventually the crown. Crown rot due to anthracnose is characteristically bluish-black (gunmetal). The “shepherd’s hook” (stem top curved over) is often observed in young, dead shoots, especially on first growth of the year. Dead, straw-colored, erect stems scattered throughout the field may indicate anthracnose infection. The disease is favored by hot, moist weather. Diseased plants are susceptible to winterkill.



Aphanomyces root rot

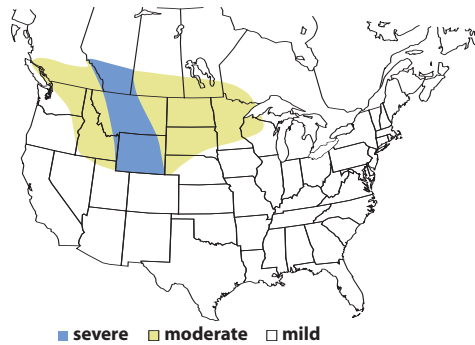
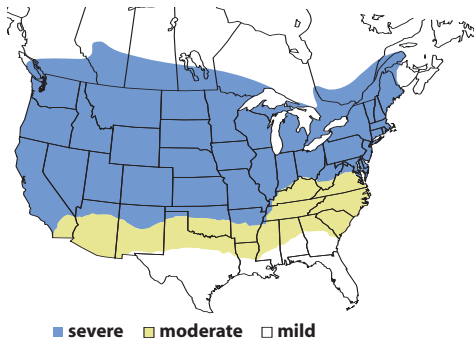
Aphanomyces stunts and kills seedlings and causes a chronic root disease in established plants. On seedlings, roots and hypocotyls are first gray and water-soaked then become brown while remaining rigid. Cotyledons and foliage appear yellowish green. On established plants, aphanomyces reduces root mass and nodules may be absent. Lateral roots may have a brown decay and lesions with mucus. Overall stunting and yellowing is common. Symptoms are similar to nitrogen deficiency. Infected plants are often slow to recover following harvest or winter dormancy. Aphanomyces is an important disease of wet soils. There are two major races of this disease. Plants with symptoms that have resistance are likely resistant to race 1 but not race 2.



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Bacterial wilt

Early symptoms appear in the taproot with a yellowish-brown discoloration just below the surface. In cross sections of the root, discoloration initially rings the outer edge; it spreads inward as the disease progresses. In the field, scattered plants become stunted, yellow-green in color, with cupped leaves. The bacteria are in the soil and usually enter through wounds. Bacterial wilt typically appears in the second or third year.



Brown root rot

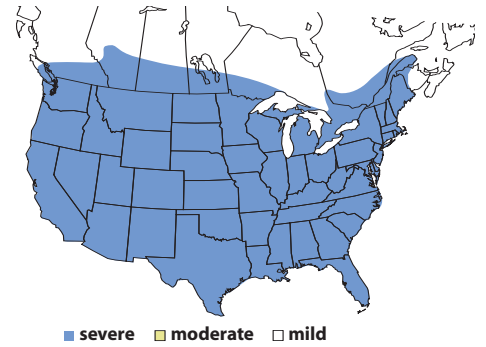
Dead or stunted plants occur throughout alfalfa stands of 2- to 3-year-old fields. Dug taproots show various stages of rot. Root infection occurs during dormancy in late fall and early spring. Early root symptoms consist of circular and slightly sunken lesions with black borders. Lesions spread and coalesce, girdling and rotting off the root. Small black fungal structures (pycnidia) are embedded in the center of dead tissue in the spring. Some plant deaths blamed on winterkill may be due to brown root rot. Seedlings are not attacked by brown root rot. This disease has been confirmed in Idaho, Minnesota, Montana, New York, Wisconsin and Wyoming. It is expected to affect the entire northern tier of states extending southward in the higher elevation mountain regions.



diseases

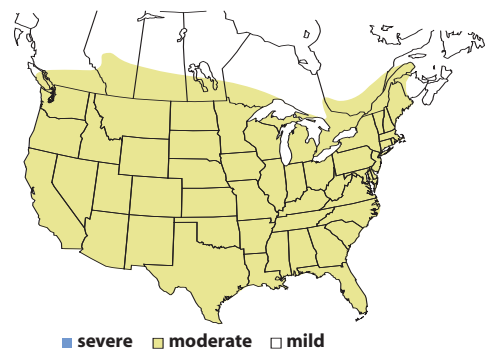
Crown rot

Crown rot may be caused by a complex of as many as four types of fungi (*Rhizoctonia*, *Stagnospora*, *Colletotrichum*, and/or *Fusarium* species). Symptoms often begin as a small cone-shaped discoloration below the base of a cut stem. The rotted area enlarges and may merge with rot from other infection sites until the central portion of the crown is destroyed, often leaving a rim of living crown tissue and stems. Some plants may partially recover and be productive for several years, while others progressively worsen until the entire crown is destroyed and the plant dies. Plant death is often blamed on winterkill. The crown and buds usually rot during the second and third year, with symptoms becoming progressively worse over time. Crown rot is usually more severe where machine traffic is heavy or in fields that are heavily grazed. Parasitic stem nematodes create entry points on the roots for the fungi that cause crown rot.



Downy mildew

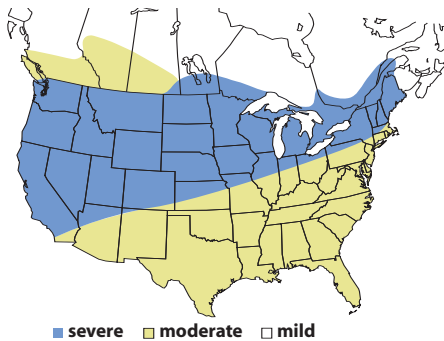
Light green to yellow blotches appear on upper leaves. Shoot tips are often dwarfed and the leaves twisted or rolled. A grayish cottony growth, the mycelium and fruiting structures of the fungus, is often visible on the underside of the leaflets. Plants do not lose their leaves. New spring seedlings may be severely injured or destroyed. Cool, moist weather and sprinkler irrigation favor disease development.



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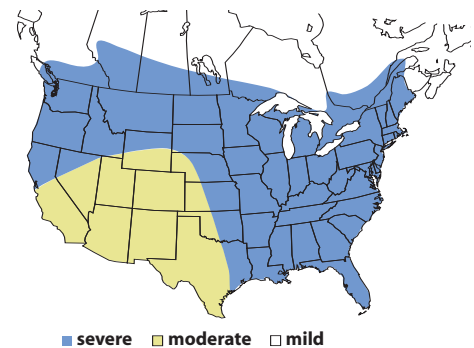
Fusarium wilt

This disease may cause stems on only one side of the plant to wilt and die or it may affect the entire plant. Stems and leaves appear bleached. Diseased plants are scattered throughout the field. In a cross section of the taproot, brown to brick red streaks initially discolor parts of the outer ring. As the disease progresses, the discoloration rings the root and the plant dies. The fungus lives in the soil and enters through wounds or fine roots. Fusarium wilt is more severe in association with root-knot nematodes.



Leaf spot, common

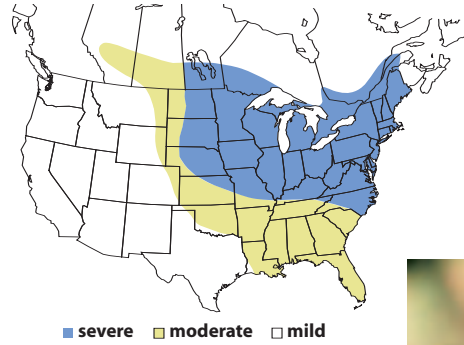
Small, circular chocolate brown spots appear on leaves. Eventually, smaller raised discs, usually lighter in color, erupt through the leaf surface in the center of the spots. Infected leaves turn yellow and drop off. Severe defoliation may occur. This disease occurs in most alfalfa stands and is favored by warm, moist conditions.



diseases

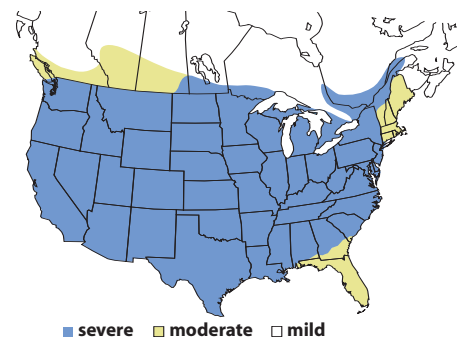
Leaf spot, lepto

Small black spots on the leaflets are surrounded by a halo. The spots enlarge and acquire a tan center with an irregular brown border. As the disease progresses, lesions often grow together. Infected leaves die and cling to the stem for a time. Only young leaves become infected; the greatest damage is seen on new growth when moist weather follows clipping. In older growth, only the young upper leaves become infected. Disease is worse in cool, wet summers. Resistant cultivars are not available.



Phytophthora root rot

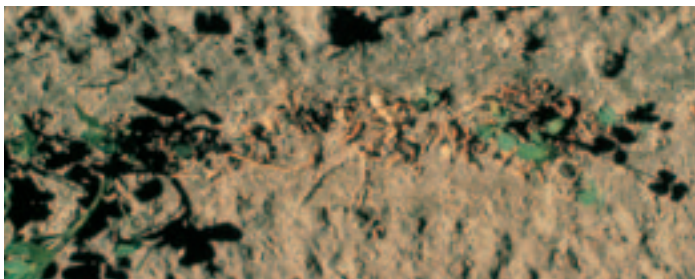
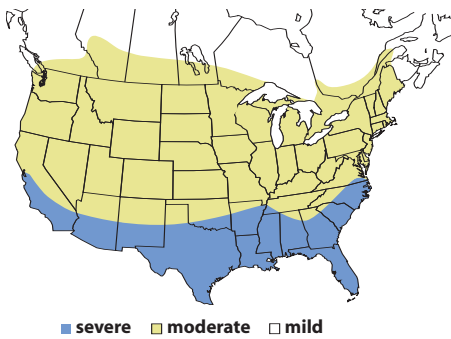
Seedlings grown in cool, wet soils may be killed just before or after emergence. This fungal root disease is favored by cool conditions and wet soils. Seedlings that survive the initial infection have rotted roots and yellowish-red leaves; they typically die within several months. On mature plants, the disease causes lesions on taproots. In severe cases the roots rot off completely. Shoots are stunted but otherwise appear normal until the plant collapses and dies or is killed over winter. Infected, unproductive plants may survive for several years before dying.



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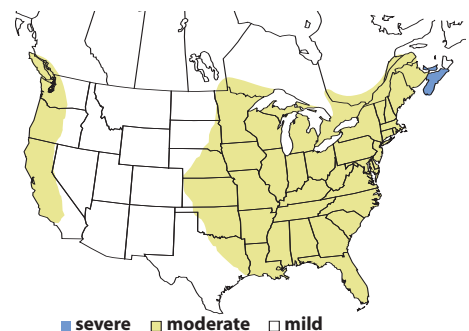
Rhizoctonia stem blight, web blight, and root canker

Stem blight girdles stems at their base, eventually killing them. Dead, straw-colored, erect stems may resemble symptoms caused by anthracnose. However, the characteristic shepherd's hook is absent. Web blight, characterized by dead leaves sticking to each other and to stems by strands of the fungus. This disease occurs in warm, humid areas of the United States, particularly after extended rainy periods. Root canker is common in the summer in the irrigated valleys of Arizona and California. These large cankers are often darker at the margins and turn black with age. The disease is most severe under high temperatures and moist conditions.



Root-lesion nematode

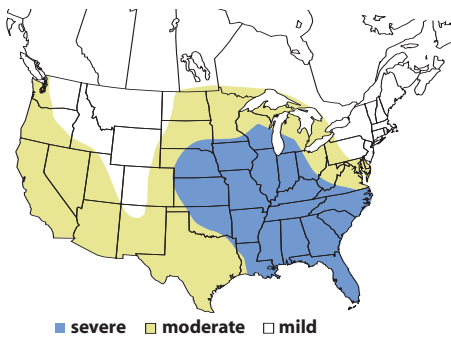
Plants appear unhealthy and stunted, usually in spotty areas within an otherwise healthy stand. The parasitic nematodes are microscopic worms that feed on root hairs, feeder roots, and nitrogen-fixing nodules of alfalfa. They reduce the plant's ability to take up soil nutrients and fix nitrogen. Root-lesion nematodes reduce yield and thin stands. Nematode populations can be reduced by rotating to row crops or fallowing for 2 months following incorporation of forage crop residue. Moderate resistance is available in some varieties.



diseases

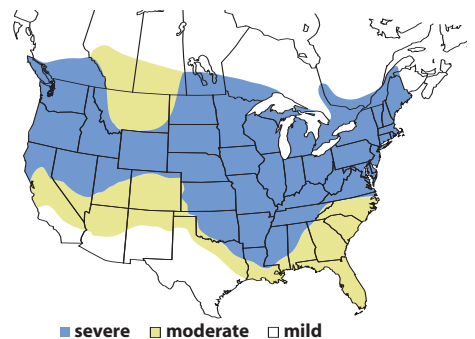
Summer black stem

Large, usually circular, light gray to black spots usually appear on lower leaves during the summer and early fall. Young spots on the leaves are often surrounded by a halo. The disease causes leaf drop, starting with the lower leaves and progressing up the stem. Reddish brown to chocolate brown oval lesions form on the stem and merge to discolor most of it. The disease is favored by warm, moist weather. Symptoms are worse on second and third cuttings.



Spring black stem and leaf spot

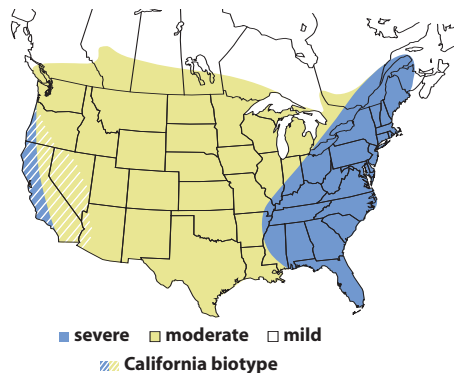
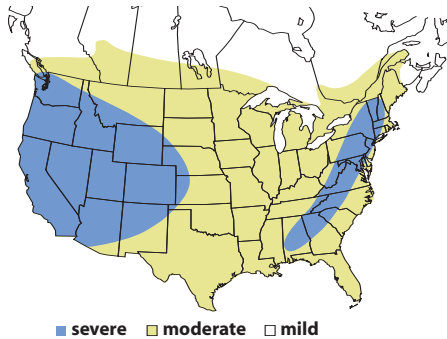
Dark spots with irregular borders appear on the older, lower leaves. They enlarge and merge until much of the leaf is covered. Leaves turn yellow and drop. On stems, lesions are dark green at first, later turning black. Lesions spread to cover most or all of the lower portion of the stem. Young shoots are often girdled and killed. The plant dies when infection spreads to the crown and roots. The disease is most severe on spring growth and is favored by cool, moist weather. Can be devastating on first growth in the cooler regions of the western states, especially under sprinkler irrigation.



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Stem nematode

Germinating seedlings may be attacked and killed. Seedlings are swollen and deformed. Stem buds of older plants are stunted, swollen, brittle and easily broken off, providing open wounds for crown-rotting organisms. Stems are usually swollen at the base, with short internodes, resulting in compacted crowns and stunted plants. Bases of the stems become brown to black. White leaves and stems ("white flagging") develop on some plants. Infected plants are predisposed to winterkill. Stem nematodes are worse in furrow-irrigated fields with heavy soils. The chrysanthemum foliar nematode produces similar symptoms and is frequently found in diseased plants along with the stem nematode in the western states.



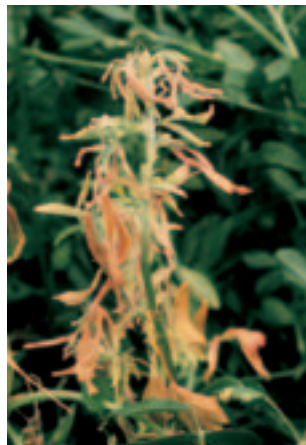
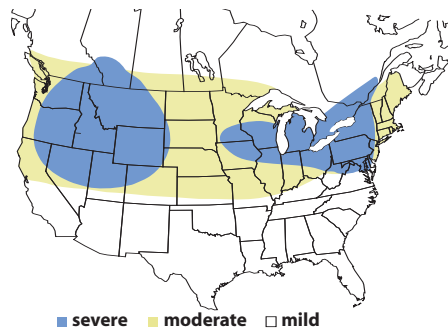
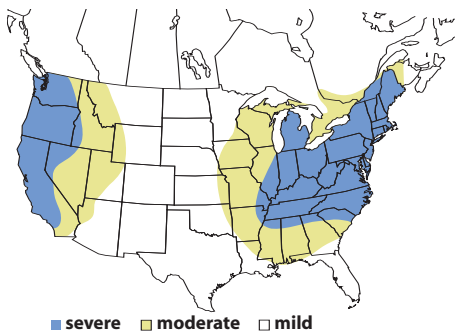
Stemphylium leaf spot

Two biotypes, eastern and California, produce somewhat different symptoms. The eastern biotype causes oval, slightly sunken, light brown spots bordered with dark brown and often surrounded by a light yellow halo. With age, lesions become concentrically ringed and may affect a large portion of the leaflet. When severe, lesions may cause general leaf yellowing and early defoliations. Stems may also be diseased and turn black. The California biotype produces somewhat irregular lesions that are light tan (almost white), with a sharply defined light brown border. Spots vary in size, but are seldom longer than $\frac{3}{16}$ inch. Spots do not change with age. Forage quality may be reduced, but early defoliation is rare. The disease shows up in the spring in the interior valleys and throughout the growing season in the cooler coastal areas. Stems are not affected.



Sclerotinia crown and stem rot

The first symptoms occur in the fall as small brown spots on leaves and stems that eventually wilt and die. The fungus then spreads to the crown. In early spring the crown and basal part of the stem become soft and discolored. As infected parts die, a white fluffy fungal mycelium grows over the area, forming hard black spores (sclerotia) which may adhere to the surface of or be imbedded in the stem and crown. Plants less than a year old are most susceptible. Disease is favored by cool, moist conditions.



Verticillium wilt

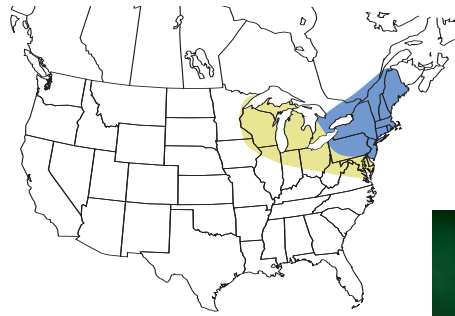
Symptoms first appear during the prebud to floral stage of first cutting. On warm days, the upper leaves temporarily wilt on scattered plants. Leaflets turn yellow to pinkish brown and curl along the midrib. Stems remain erect and green or they may take on a bleached appearance (chlorotic) for a while after the leaves die. Within the taproot, a yellowish to brown discoloration is usually present. Regrowth appears normal in most infected plants, but symptoms reappear as top growth approaches the prebud stage. Plants become progressively weaker and usually die later in the season when plants are stressed for moisture. Disease is favored by cool, wet conditions. It is most prevalent on spring and fall growth.



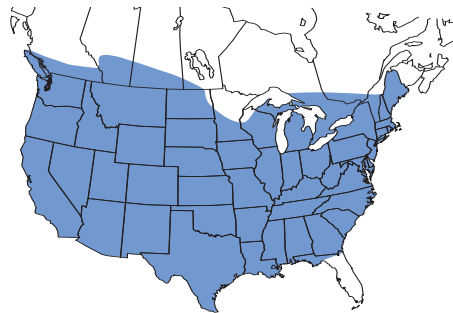
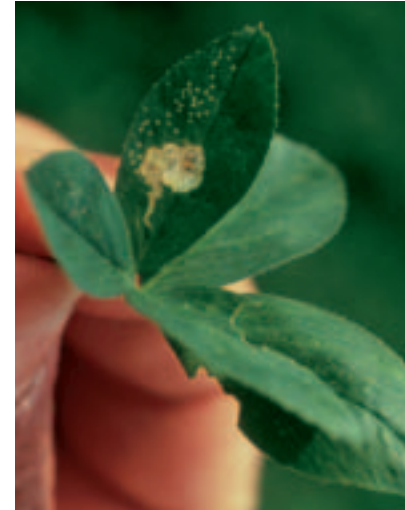
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Alfalfa blotch leafminer

The adult leafminer is a tiny dull-black humpbacked fly which emerges in late May from overwintering pupae on the ground. The fly's presence is best recognized by pinholes in leaflets caused by egg laying. The female deposits one to three eggs per leaflet and she may lay over 3,000 eggs during her brief lifetime. Small yellow maggots hatch within the leaf and begin feeding between the upper and lower leaf surfaces. A tunnel is formed as feeding progresses, usually beginning at the base of the leaf, widening as it approaches the leaf tip, and ending with an enlarged comma-shaped blotch. The mature larvae leave their mines and drop to the ground to pupate. There can be up to four generations a year of this fly in alfalfa.



■ severe ■ moderate □ mild



■ severe ■ moderate □ mild

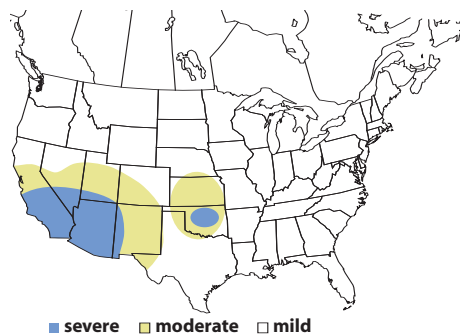
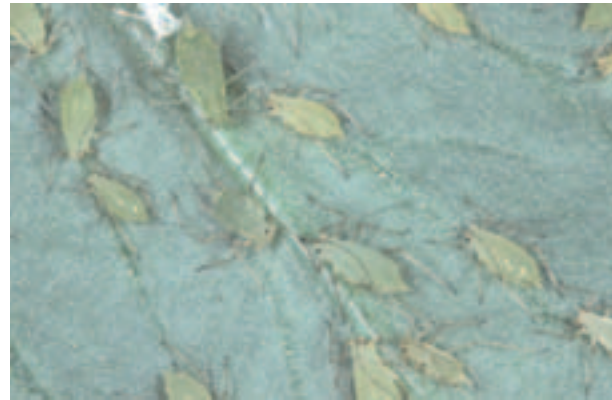
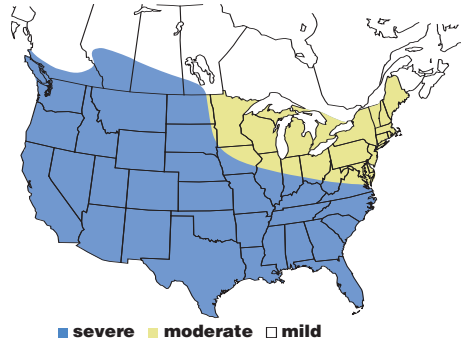


Alfalfa weevil

Alfalfa weevil damage starts in early spring when the larvae hatch from eggs laid in alfalfa stems. Larvae have black heads and a white stripe down the back. Newly hatched larvae are yellow or light green; older larvae are darker green. Larvae feed first in the growing tips and shred the foliage, which gives heavily infested fields a grayish cast. Adult beetles are about $\frac{1}{4}$ inch long, light brown in color, with a darker brown stripe down the back. Damage to first-cutting alfalfa is mainly from larvae, but both larvae and adults can be present after the first cutting, feeding on the regrowth. Larvae mature to adults in early summer and leave the fields but may return in the fall and start depositing eggs. Biological control agents (parasitic wasps and a fungus) have greatly reduced the impact of the alfalfa weevil in the eastern regions of the country.

Pea aphid

This large green aphid is common on alfalfa. It builds up large populations which cover the stems and terminal buds during cool, wet springs. It causes damage by sucking sap from the terminal leaves and stem, causing the plants to wilt. Feeding can wilt plants or even cause death if infestations are large. Plants that survive heavy infestations are stunted with more light colored tops than healthy plants. Injury is similar to that caused by blue alfalfa aphids. Large infestations also produce excessive honeydew which may interfere with harvesting. Usually, as drier and warmer weather develops, natural enemies help reduce infestations.



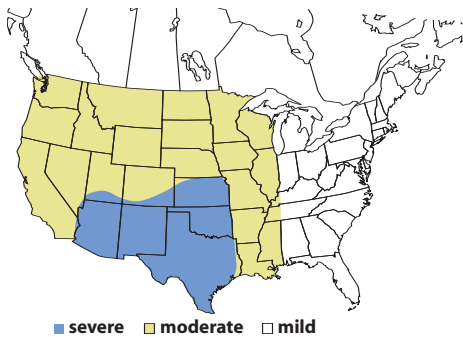
Blue alfalfa aphid

The blue alfalfa aphid was first found in California in 1974 and now occurs in several western and midwestern states. It is similar to the pea aphid in appearance, but can be distinguished by its bluish-green coloration in contrast to the yellowish or light green color of the pea aphid. The antennal segments of the blue alfalfa aphid are uniform brown in contrast to the pea aphid which have narrow brown bands at the tip of each segment. Severe aphid infestations slow alfalfa growth, reduce yields, and may kill plants. Alfalfa's feed value and palatability can be reduced by a black fungus that grows on the honeydew excreted by the aphids.

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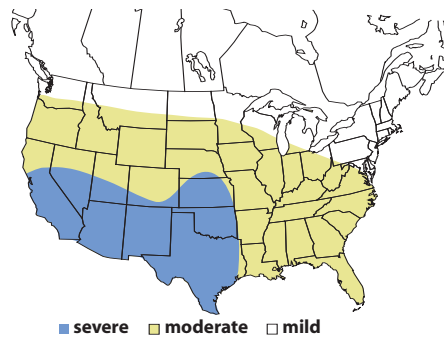
Cowpea aphid

This aphid is the only black aphid found infesting alfalfa. It is relatively small and the adult is usually shiny black, whereas the nymph is slate gray. The legs and antennae are usually whitish with blackish tips. Large populations will stunt alfalfa growth and it produces a considerable amount of honeydew upon which sooty mold grows. The honeydew also makes the alfalfa sticky, which can cause problems with harvest. Damage has been greatest in California, but it also occurs in the Midwest.



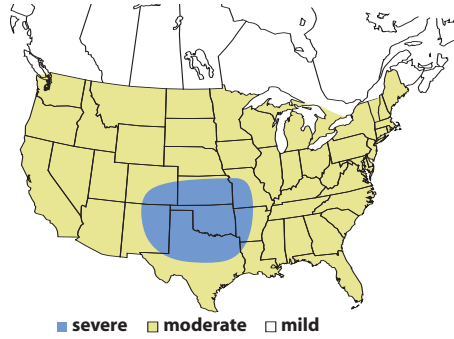
Spotted alfalfa aphid

This tiny aphid is light yellowish green or straw colored, with rows of dark spots on its back. Unlike the pea aphid, it develops under hot, dry conditions. It causes severe stunting and yellowing of plants and will kill seedling stands. It secretes an abundance of sticky honeydew on which a sooty black fungus may develop. This aphid is most severe in the arid areas of the western and southwestern United States.



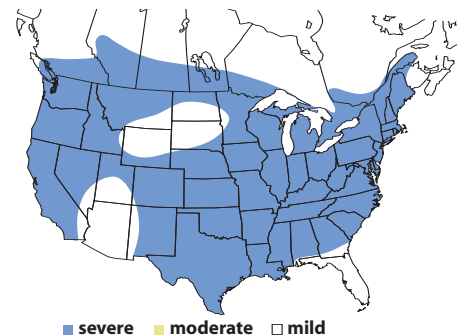
Blister beetles

Several species of blister beetles are common in alfalfa fields. Among them, the orange and brown striped, black, and gray-colored blister beetles are common in the Midwest. Although these insects cause little injury to alfalfa, they are significant as pests when they are killed by cutting equipment and incorporated into the baled hay. Later, when horses ingest the dead beetles along with the hay, a toxin known as cantharidin in the beetles may cause serious illness and possible mortality. As few as 25 beetles consumed by a small horse may kill it, while larger horses may suffer from diarrhea, colic, and internal bleeding. The first cutting of alfalfa often has the fewest blister beetles while mid- and late summer cuttings typically have larger populations of these insects.



Clover leaf weevil

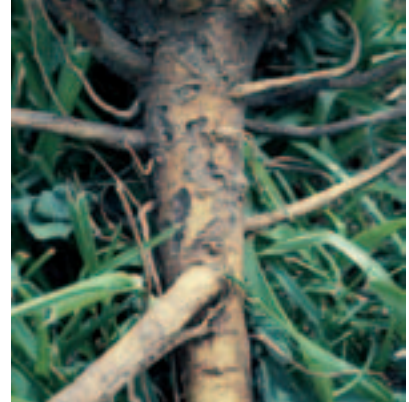
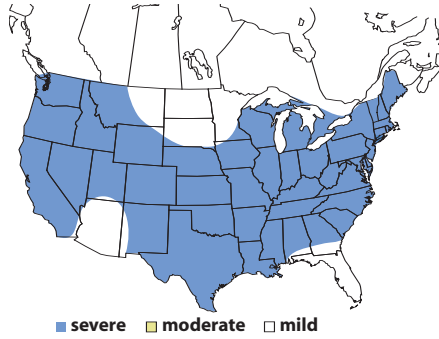
Larvae look similar to alfalfa weevil larvae except they are larger (1/2 inch long), have brown heads, not black, and the white stripe is frequently tinged along the edge with pink. They feed on alfalfa at night or on overcast days, very early in the spring. Clover leaf weevil populations are reduced by a fungal disease before they cause extensive damage to alfalfa. Larvae attacked by this fungal disease often curl around a stem before dying.



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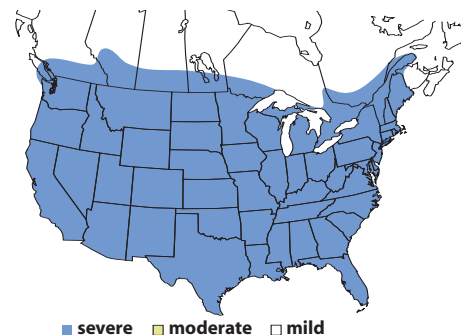
Clover root curculio

The adult clover root curculio is a small, slender, dark gray snout beetle about $\frac{3}{16}$ inch long. It feeds on the foliage, but this seldom causes economic damage. However, larvae can extensively damage alfalfa taproots, particularly in older stands. Damage is characterized by extensive scarring of the outer layers of the roots. These lesions may become avenues of entrance for various disease pathogens, causing wilt and root rot, and reducing the life of the alfalfa plant.



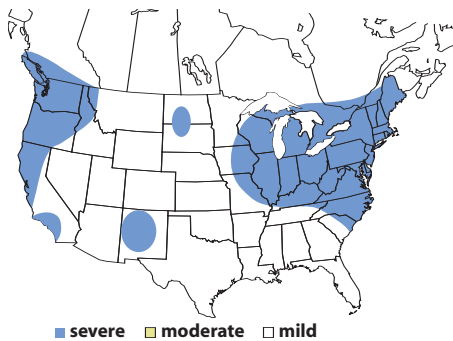
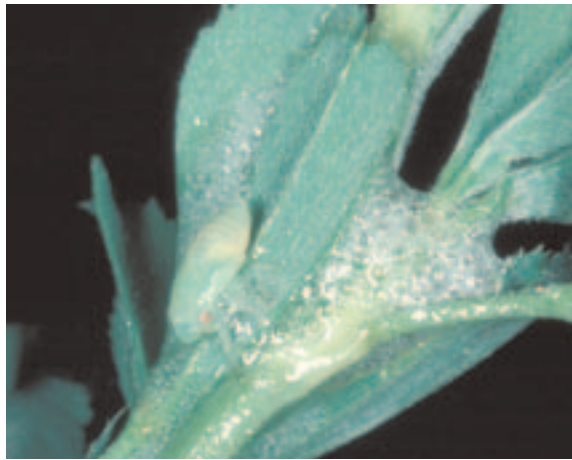
Grasshoppers

The differential and redlegged grasshoppers are two of several species of grasshoppers that attack alfalfa and cause serious damage. Grasshoppers become most numerous in uncultivated areas. Consequently, heaviest infestations are usually found in field margins, fence rows, pastures, grass waterways, etc. Their populations are often the largest during hot, dry years. Young alfalfa is a favorite food of grasshoppers and they will move from field margins into these new seedlings, causing extensive damage.



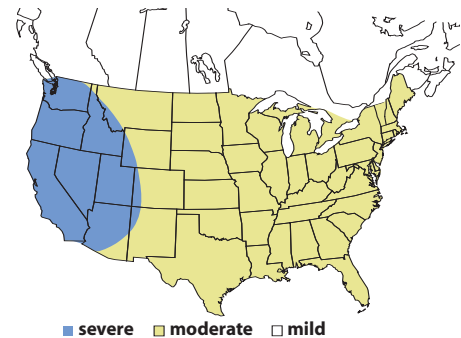
Meadow spittlebug

The meadow spittlebug is an early spring pest. A characteristic feeding symptom is a frothy spittle secreted by the yellowish green nymphs as they feed. The spittle accumulates on the alfalfa stem and provides protection for the nymph. Feeding by numerous nymphs on a plant may cause stunting with a shortening of internodes so that the leaves are bunched together in a rosette appearance. The brown-banded adults emerge in early June and cause little economic damage to alfalfa.



Plant bug

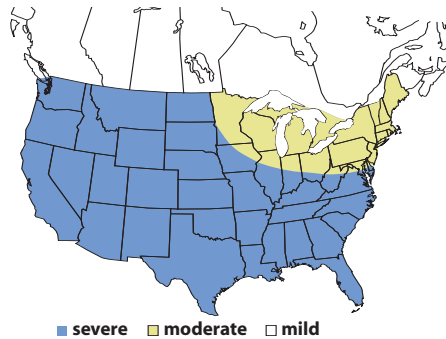
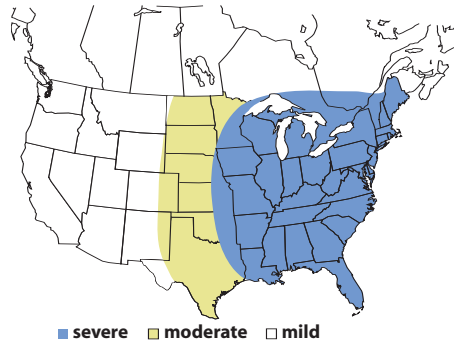
There are several species of plant bugs common in alfalfa fields. The tarnished plant bug, and the alfalfa plant bug, are the most common in the Midwest and in the East. Plant bugs cause serious damage to seed but are not usually considered forage pests. However, they suck the juices from the foliage, resulting in crinkled and puckered plant tips and which occasionally causes forage loss.



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Potato leafhopper

This tiny ($\frac{1}{8}$ inch) light green insect is a common cause of alfalfa yellowing, known as "hopperburn." The nymph or immature stage is light yellowish green and characteristically walks sideways. The adults are rapid jumpers and flyers. Feeding causes severe stunting of the plants and yellowing of the foliage. Leafhopper damage starts as a V-shaped pattern at the tips of the leaves. The first cutting of alfalfa is not usually affected, but subsequent cuttings may be severely damaged. Extensive hopperburn can reduce long-term yield and plant stand health. New seedlings are especially susceptible to damage.



Variegated cutworm

This cutworm prefers non-grass crops and can cause extensive damage to alfalfa during warm, wet springs. When fully grown, it is about 2 inches long and may range in color from almost black to light greenish yellow or tan. It has a distinctive row of light yellow diamond-shaped spots aligned down the middle of the back. The worms feed mainly at night and hide under soil clods or in soil debris during the day, or rest on the shaded side of alfalfa stems. Larvae are most damaging on the regrowth after the first alfalfa cutting. Other species of cutworms occasionally damage alfalfa.



nutrient deficiencies

Acid soils

Alfalfa grown on low pH, acid soils are light green and stunted. Stands are difficult to establish and thin quickly. Yields are greatly reduced. Aluminum and manganese may be toxic to alfalfa plants on highly acid soils. Adding agricultural limestone increases soil pH and reduces the availability of these toxic elements. Increasing the soil pH on many soils increases the availability of soil molybdenum, stimulating nitrogen-fixing bacteria in root nodules. It also may increase the availability of soil phosphorus and some other nutrients. Lime provides varying amounts of calcium and magnesium depending on the type of limestone.

Potassium

Potassium deficiencies are much more common in areas that receive 25 or more inches of precipitation per year. The distinctive symptom of small white spots or flecks around the outer edges of the leaflets is very characteristic. Although the spots are usually most obvious on the upper leaflets, marginal yellowing is greatest on the lower leaves. Under severe conditions the size and number of spots increase and the leaves turn yellow and dry, and may drop off the plant. Alfalfa stand failure, winterkill, and encroachment by grasses may also be signs of low potassium levels. Soil tests and plant analysis may be used for predicting potassium needs.

Phosphorus

Phosphorus-deficient alfalfa often does not exhibit distinct symptoms other than stunted growth. Roots may be light brown and tops stunted, stiff and erect. Leaves, especially on acid soils, may be small and abnormally dark or bluish-green. Well-calibrated soil tests may be particularly useful for predicting phosphorus needs.



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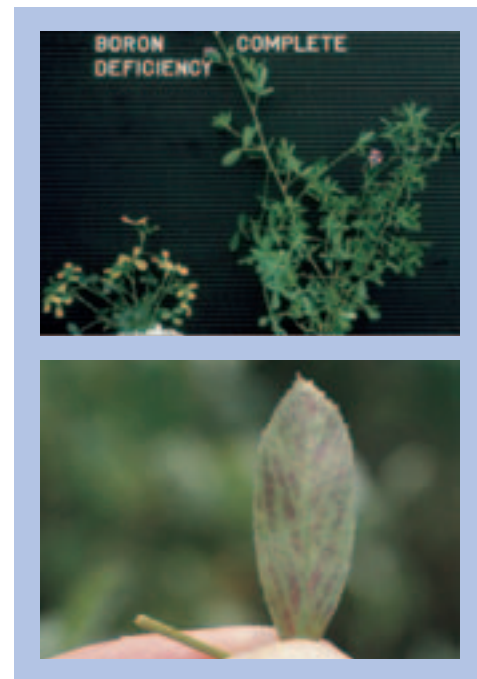
Sulfur

Sulfur deficiency is most common on excessively drained, sandy, low organic matter soils located away from urban or industrial areas. However symptoms will occur on silty and loamy soils and distance from urban areas is becoming less of a factor as air pollution is being reduced. Manure contains sulfur and may meet plant needs if applied in adequate quantity. Deficient plants tend to be entirely pale green or yellow, stunted, and unthrifty. Soil tests typically do not account for all sulfur inputs. They usually correctly identify the available sulfur status only when adequate amounts of sulfate are present in the plow layer. Plant tissue analysis may be helpful in diagnosing sulfur deficiencies,



Boron

Boron-deficient alfalfa is sometimes called "yellow top" and is often misdiagnosed as leafhopper damage. The top leaves become yellow or reddish yellow. Plant tops may become bunched with shortened internodes and the growing tip may die while the lower leaves and branches remain green. Deficient plants do not bloom normally and produce poor seed yields. Symptoms are most prevalent during dry periods, particularly on coarse-textured soils with low organic matter. When moisture conditions improve, side branches may resume growth and extend beyond the main stem.



Molybdenum

Molybdenum-deficient alfalfa tends to be pale or light green because molybdenum is essential for nitrogen fixation. Deficiency occurs on very acid soils. Increasing the soil pH increases solubility and availability of soil molybdenum.

damage

Heaving

Heaving usually occurs on soils with significant clay content, high in moisture and subject to freeze/thaw cycles. Freezing causes the wet soil to expand and exert upward pressure on the crown. When freezing alternates with thawing and soil shrinkage, the pressure can be great enough to lift the root and crown. The taproot will often break when the base of the root is frozen solid. Heaving is most common in the spring but may be severe in late summer or fall seedings because of less-developed root systems on new seedlings.



Traffic damage/compaction

When alfalfa is subjected to excessive traffic, or, especially, traffic when the soil is wet, loss of yield and stand can result. The soils become compacted and less aerated which results in poor nutrient utilization. Traffic can also break stems and increase root disease problems and crown damage. Stand loss in high-traffic areas is common.



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Winter injury

Alfalfa plants form buds in the fall for growth the following spring. When any of these buds are killed over winter, plants green up with fewer shoots than optimum. Severe winters, lack of snow cover, insufficient winterhardiness, and/or poor management may contribute towards making plants vulnerable to winter injury. Injured plants often form new buds in the spring, however, shoots arising from these buds will be significantly behind in development. Thus, when the tallest stems are 6 inches tall, shoots starting from spring-formed buds will be only 2 to 3 inches tall. To evaluate the extent of winter injury, examine fields when the tallest shoots are about 6 inches tall. Look for high shoot density per plant and for uniform height of shoots.



Winter kill

When alfalfa crowns are exposed to temperatures below 15°F, the entire alfalfa plant may be killed. Contributing factors include lack of snow cover (an excellent insulator), lack of crop residue, lack of genetic winterhardiness, low soil fertility, and/or low pH. Symptoms will be visible as the ground thaws. Crowns and taproots turn soft and fibrous, and a distinct brown line is often visible across the taproot 2 to 3 inches below the soil surface.



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