BARLEY DISEASES

Barley diseases are very similar in symptoms to wheat and oat diseases. For additional Internet references, see **Wheat Diseases** and **Oat Diseases**.

Barley diseases may be combated in three ways:

1. Growing Disease-resistant Varieties

The list of approved disease-resistant varieties is constantly changing. When disease control by resistant varieties is advisable, growers should consult the county Extension agent for the latest recommendations. Switching to other varieties may be desirable since new diseases or new races of old diseases may come into a locality at any time and attack barley.

2. Following Cultural Practices

Sanitation and approved cultural practices for the control of some barley diseases are discussed in the following pages. These include such generally recommended measures as plowing under stubble and other plant litter that may allow disease organisms to live from one season to the next. Other practices include crop rotation, proper land preparation, and time of seeding.

3. Treating Seed

Seed treatment is effective in controlling seedborne diseases. Some of the better chemical treatments also protect germinating seeds against soilborne organisms causing seed rot, damping off, and seedling blight. Stripe diseases, loose and covered smut, and loose smut, for example, can be prevented with effective chemical seed treatments. These treatments also control the seedborne phase of several other barley diseases such as bacterial blight, scab, net blotch, and spot spores from neighboring fields. However, seed treatments do not control other diseases such as rusts and mildew, scald, and some virus diseases.

Chemical fungicides, marketed either as dusts or liquids, are applied to seed in several forms and by several methods. Fungicidal dusts may be applied to seed either directly or in a thick water suspension called slurry. Liquids are sprayed or misted directly on seeds.

SMUTS

Covered smut, black semi-loose smut, and loose smut are major barley diseases in the United States.

COVERED SMUT

http://www.ppws.vt.edu/stromberg/smallgrain/biology/bcsmut.html

Symptoms -- This disease first becomes noticeable at heading time. Hard, black masses of smut spores, each covered with a grayish membrane, are found in the place of kernels in affected heads. Each smutted head contains millions of tiny spores, which spread to healthy seeds while the grain is harvested, or in storage. In addition, spores lying dormant in the soil also spread the disease. The barley seedling becomes infected during the period between germination and the time the seedling emerges.

Optimal Environmental Conditions -- The highest percentage of infection occurs at soil temperatures of 50^{o} to 70^{o} F during pre-emergence; mild temperatures two to four weeks after the seedlings emerge encourage later smut development. More smut develops in plants grown in acid soil than in those grown in neutral or alkaline soil.

Control -- Treating seeds with an appropriate fungicide may control covered smut.

SEMI-LOOSE SMUT

Symptoms -- Usually, the disease is first noticed when the dark, smutted heads appear. Each head contains millions of loosely held dark-brown microscopic spores scattered by the wind when the healthy heads are in bloom. Some spores come in contact with the flowers and the developing seeds of healthy heads. Seed infestation occurs when the spores come into contact with healthy heads. Depending on moisture and temperature conditions, the spores may lie dormant or may germinate and infest the seed hulls, which, in turn, infect the young seedlings at planting time. Spores on the seed surface also may cause plant infection.

Optimal Environmental Conditions -- Temperatures of 60^{o} to 70^{o} F and relatively dry soil during emergence favor infection. As with covered smut, mild weather conditions for two to four weeks after the seedlings appear cause a higher percentage of smut than constant low temperatures.

Control -- Seed treatments controlling covered smut also control semi-loose smut.

LOOSE SMUT

http://www.ppws.vt.edu/stromberg/smallgrain/control/blsmut.html

Symptoms -- Nude loose smut and black semi-loose smut cause a similar amount of damage to barley. The appearance of smutted heads and the spread of spores during the flowering of healthy heads are also similar with both diseases.

An important difference occurs, however, after the nuda spores reach the barley flowers. The spores normally germinate at once and develop long, slender infection threads that enter and grow deeply within the developing seeds. Unlike covered smut and semi-loose smut, which are carried on or in the shallow glume layers near the surface of the seed, the nude smut fungus becomes so deeply embedded within the germ or barley kernel embryo, that it must be controlled by treating the seed with hot water soaks or systemic fungicides.
Optimal Environmental Conditions -- Loose smuts are widely distributed in humid and

subhumid areas, but are less common in dry areas.

Control -- Losses due to nude loose smut can best be avoided by sowing certified smut-free seed. If such seed is not available, seed treatment by a systemic fungicide is the best alternative. Because the fungus is carried in the embryo or seed germ, nuda loose smut cannot be controlled by protectant chemical seed treatments.

BARLEY RUSTS

STEM RUSTS

http://www.ipm.ucdavis.edu/PMG/r730100711.html

Sometimes, stem rust seriously injures barley. The same stem-rust fungus that attacks wheat and rye causes it.

Symptoms -- Pustules (blister-like spots) that break through the surface of stems, leaves leaf sheaths, and, often, chaff and beards recognize the disease. In severe attacks, the kernels are badly shriveled. Rusted stems turn brown, become dry and brittle, and soon break over.

Rust overwinters on the stubble and straw of barley, wheat, and rye as black, thick-walled, cold-resistant spores. These spores germinate in spring and produce secondary spores that cannot infect barley, but lead to an infection of the leaves of the common European barberry bush. On this bush, the rust produces spores that cannot reinfect the barberry, but can infect barley plants and produce the red-rust stage. This stage may persist on barley during spring and summer and may produce successive crops of red spores every 10 to 14 days until growing conditions become unfavorable. The overwintering black spores then appear again.

Control -- The use of early varieties and cultural practices such as early seeding and the use of phosphate fertilizers that hasten ripening may help. However, they do not prevent damage when the infection is severe. Late seeding delays ripening, and is likely to increase the rust damage because it provides a longer period for rust development. Heavy applications of barnyard manure or nitrogen fertilizer also may delay ripening and produce a heavy vegetative growth that retains moisture and favors rust development.

Extensive eradication of the common barberry has greatly reduced stem rust damage. The discovery that rusts may hybridize on barberry bushes and thus produce new and more virulent rust races are often given as an additional reason for continuing eradication efforts.
Breeding for varietal resistance to rust is one of the most promising methods for controlling all small grain rusts. Extensive trials have shown that stem and leaf rusts of wheat and spraying fields with certain fungicides can prevent other cereals. At present, however, this method is too costly to be practical in light of current disease losses.

LEAF RUST

http://cygnus.tamu.edu/Texlab/Grains/Barley/blr.html

Barley leaf rust is seldom a concern in areas where spring barley is grown; however, it may be locally destructive locally to winter barley. Occasionally, leaf rust becomes so severe that grain yield and quality are reduced.

Symptoms -- Small, round, yellow or yellowish-brown pustules of the summer stage of leaf rust appear on the leaves or leaf sheaths of barley plants. In the southern winter barley regions, the rust overwinters in this stage and spreads northward in spring. Infection in the northern barley areas is frequently not evident until late spring or early summer.

Control -- The use of resistant varieties is the only practical control method.

POWDERY MILDEW

http://cygnus.tamu.edu/Texlab/Grains/Barley/bpm.html

Powdery mildew is more damaging to barley than most other cereal crops. When severe, it may reduce yields by 25% or more. Like many diseases, it reduces or impairs the green leaf tissue that plants need to manufacture sugars and starches. The plants produce fewer heads and fewer kernels per head when powdery mildew damage or other leaf blights occurs early and disease development continues through flowering.

Symptoms -- The first indications of infection are small, white or light-gray spots of cottony threads on the upper surface of leaves. The spots enlarge, darken, and become powdery with age, producing millions of spores to infect other plants. Eventually, the spots may cover large areas of the leaf. A yellowing followed by browning and gradual drying of the leaf usually accompanies this process.

The mildew mainly grows on the upper surface of leaves; it rarely grows on the undersurface. In severe attacks, the mildew may be found on stems, glumes, and awns.

As the plant approaches maturity, tiny, black reproductive bodies of the fungus develop in infected areas; these may help the fungus overwinter. Mildew is more severe, however, on tender, rank growing plants. Thick seeding, heavy application of nitrogen fertilizer and other factors that promote a heavy, leafy growth are not recommended.

SCAB

http://www.cdl.umn.edu/Scab/scabfact.html

Scab, also known as Fusarium head blight, sometimes severely damages barley, wheat, rye, some grasses, and corn. The scab fungus also causes a foot rot and seedling blight of barley.
Symptoms -- The scab head blight develops in warm, humid weather during kernel formation and ripening. Infection begins in the flowers and frequently spreads to other parts of the head; the diseased area turns light brown. Often, a pink, moldy growth develops around the base of the

infected flower, and black fruiting bodies may be found on the glumes. Kernels of diseased heads are grayish brown and lightweight. The kernel interiors become flowery and discolored, and toxins are formed that cause acute vomiting when the grain is eaten by hogs, dogs, or man. Sheep, cattle, and mature poultry, however, are not affected, and scabby barley may be fed to these animals.

The scab fungus overwinters on barley seed and in plant residues of barley, corn, and other affected crops of the previous season. When sown, infected seed produces infected seedlings. Spores borne on diseased plant litter, such as corn stubble, also may cause seedling infection and later may cause infection of the flowers of the young barley heads. Largely fungus threads from diseased plant residue in the soil invade the crown tissues of the barley plant.

Control -- The use of clean seed and treatment of diseased seed with fungicides are effective methods of controlling seedling infection. Sanitation, crop rotation, and early seeding help reduce crown infection and head blight.

SPOT BLOTCH

http://cygnus.tamu.edu/Texlab/Grains/Barley/bsb.html

Spot blotch is widespread and may cause severe damage. The causal fungus may be seedborne or present in the soil; it overwinters in the seed and on crop residue.

Symptoms -- The spot blotch fungus attacks barley, wheat, rye, and many grasses. All parts of the barley plant are affected. On seedlings, dark brown to black discoloration appears on the blade or sheath of the first leaf, and the seedling may be killed; diseased seedlings' roots show darkened areas and rotting. In addition, dark brown spots appear on the leaves and fuse to form blotches that may cover large areas of the leaf blade; heavily infected leaves dry out and mature early. On the germ end of diseased kernels, numerous dark brown spots may appear; a condition commonly called "black point." Grain containing 5% or more of black point kernels bring a lower market price.

Control -- Resistant varieties and seed treatment are the best control methods. Sanitation and crop rotation are important; however, in the spring grain area, crop rotation is not effective because a large percentage of the acreage is planted in other grains and grasses also harboring the disease.

NET BLOTCH

http://cygnus.tamu.edu/Texlab/Grains/Barley/bnb.html

Net blotch is very common, especially when cool weather prevails during much of the growing season. Usually, the disease isn't a major concern, but it may cause considerable damage under conditions favorable for its development.

Symptoms -- Brown areas appear on the leaves from the seedling stage until maturity. These areas show a network of dark-brown lines within an area of lighter brown; the netted areas enlarge and fuse during the growing season. Spores produced on diseased leaves are blown to other leaves, and repeated secondary infection spreads the net blotch to other plants. The fungus overwinters in infected seed and on old straw and stubble.

Control -- Resistant varieties, sanitation, and crop rotation control net blotch. Barley sown on or near fields with diseased surface stubble may become heavily infected. Seed treatment kills the fungus carried on the seed.

BACTERIAL LEAF BLIGHT

Bacterial leaf blight is widely distributed, especially in the spring barley areas. Usually, it isn't a major concern, but occasional severe outbreaks on susceptible varieties may reduce yields.

Symptoms -- Diseased plants develop irregular, narrow, glossy-surfaced stripes on the leaves. The stripes frequently show water-soaked areas ranging in color from light yellow to dark brown. The affected leaf areas exude small drops, or a film of a white sticky bacterial substance, which dries to a thin, flaky layer. Similar diseased areas may develop on leaf sheaths and floral parts. Severe late attacks result in head blighting.

Optimal Environmental Conditions – The disease is caused by bacteria, which favors wet weather and is spread by rain and insects. The bacteria persist from season to season on the seed in crop residues and the soil.

Control -- Crop rotation and seed treatment with fungicides helps control the disease. However, occasional disease outbreaks occur regardless of control measures. Some barley varieties are more resistant.

SCALD

http://res.agr.ca/winn/hd2g.htm

Scald is a major concern, important chiefly in the winter barley areas of the United States. This disease also attacks rye and certain grasses. Severe attacks have caused losses of up to 20%.

Symptoms -- Scald appears as oval or lens-shaped spots, which are first water-soaked and gray-green. Later, the spots appear as pale or white central areas surrounded by irregular rings of brown tissue.

During the growing season, spores produced on diseased leaves spread the disease. The fungus overwinters on infected dead leaves and probably on other crop residue. From these overwintering sites, the fungus spreads to barley seedlings the following spring. The disease favors a cool growing season.

Control -- Resistant varieties, crop rotation, and tilling under the crop residue are the best control methods.

ERGOT

Ergot attacks barley and other cereals, and many wild and cultivated grasses. Usually, it is more severe on rye than barley and wheat; however, certain barley and wheat varieties may be heavily infected.

Symptoms -- The horn-like ergot bodies (sclerotia) in the barley heads readily recognize the disease. At harvest time, these sclerotia fall to the ground or are harvested with the grain. The sclerotia that overwinter in the soil germinate in the spring by sending up long, slender stem-like "stripes," which produce spores about the time the barley is in flower; the spores are carried by the wind to the barley flowers, which become infected.

The fungus produces another type of spore in the barley flowers along with a sugary liquid, or "honeydew." Insects are attracted by and feed on this honeydew and then carry the spores to other barley heads, which, in turn, become infected. Later, the fungus forms ergot bodies in the barley heads.

Ergot sclerotia contain a poisonous material that makes ergot-infested seed unusable for feed or flower. In the United States, grain is classed as "ergoty" when it contains more than 0.3% of ergot sclerotia by weight. In the past, such grain was discounted heavily.

Control -- The ergot fungus spreads readily to barley from many weedy grasses in or near the barley field. Crop rotation and the removal or cutting of such grasses may reduce the disease; modern seed-cleaning machinery removes ergot bodies from the seed grain. Also, the sclerotia may be separated from the sound barley by immersing the ergot-infested seed in a 20% solution of common salt made by dissolving 40 pounds salt in 25 gallons water. The ergot and light kernels will float and may be skimmed off; the seed must be rinsed in fresh water to remove the salt. Fortunately, the ergot bodies do not remain viable longer than one-year so old seed containing ergot does not carry the disease.

VIRAL DISEASES

Most plant viruses impair production of or destroy chlorophyll; the important substance that enables the green leaf to manufacture sugars and starches. Some viruses merely stunt or deform the plants while others give no indication of their presence in the plants. Barley is susceptible to two virus diseases: stripe mosaic and yellow dwarf.

STRIPE MOSAIC

Stripe mosaic is only known virus transmitted through the plant seeds belonging to the grass family. Experiments have shown it may cause considerable yield reductions. In some spring barley areas, it seriously affects barley production.

Symptoms -- The symptoms of stripe mosaic vary with the barley variety, the viral strain, and seasonal conditions. The viral strains of the virus may cause brown stripes in the leaves; however, the most frequent symptoms are bleached, yellow or light green stripes, light green to yellow mottling, and, sometimes, an almost complete yellowing of the leaves. Plants become severely stunted when much of the chlorophyll in the leaves is destroyed.

The less virulent strains of the virus rarely cause brown stripes bleached and yellow patterns somewhat like those caused by the virulent strain usually result. Sometimes, symptoms do not appear in the upper three or four leaves, although the virus is present in them. Healthy plants can become infected when they are whipped against diseased plants by wind currents and, sometimes, when they receive pollen from diseased plants.

Control -- Since the virus is carried from crop to crop in the seed, it is desirable to avoid sowing infected seeds. Seed samples can be tested for infection by sowing them in a greenhouse at temperatures near 80^{o} F under good light conditions during early seedling development. Most infected seedlings will show symptoms in the first to third leaves. If these are discarded as soon as they are observed, the remaining seedlings can be an initial source for stocks of virus-free seed. Some barley varieties have shown signs of resistance to stripe mosaic; it's possible that completely resistant varieties will be developed. No known treatment will kill the virus without killing the seed.

YELLOW DWARF

http://www.ppws.vt.edu/stromberg/smallgrain/biology/bydwarf.html

Symptoms -- This virus causes a brilliant, golden yellowing of the leaves and moderate to severe stunting of the plants. The younger the plants when infected, the more severe the infection. Symptoms differ with the variety of barley, but yellowing of the leaves is always the first indication the plant is infected. Also, the root system growth is retarded. The disease is not transmitted through seed or soil. Five different species of aphids spread the disease from plant to plant. Wheat and oats also are susceptible.

Control -- Disease severity is somewhat decreased by early sowing so the plants are fairly well developed by the time the weather is warm enough for aphid activity. Complete control of aphids will, of course, eliminate the disease. The eventual control of the disease lies in the development of resistant varieties.

ROOT ROTS

http://www.acesag.auburn.edu/department/grain/ANR543.htm

The term "root rots" is here applied to all diseases affecting the roots, crown, and other basal parts of plants. The root rots of barley and other small grains are among the least evident diseases. At times, they cause considerable losses in barley, oats, and wheat. The various types of root rot have been given such names as seedling blight, take-all, basal stem rot, and foot rot.

Some root rots are easily recognized, but others are difficult or impossible to identify without laboratory examination.

Symptoms -- The root rot fungi attack all underground plants and may cause seedling blight, plant stunting, yellowing and bleaching of foliage, discoloration of roots and stem bases, and premature plant death. The same organisms also may infect the upper parts of plants and cause head blight, leaf lesions, and rooting of nodes. Barley plants are subject to attack by these fungi from the time the seeds germinate until the plants mature.

Optimal Environmental Conditions -- When susceptible crops are grown year after year, the root-rotting fungi tend to multiply in the soil.

Crop rotation and other cultural practices, therefore, can reduce their presence. The root-rotting fungi favor various conditions unfavorable to barley plant. Generally, seedling blights and root rots are most severe at relatively high temperatures. Rusts and other leaf diseases, insect damage, and winter injury to fall-sown grain may increase susceptibility to root rots.

Control -- Good agricultural practices can reduce root rots. Sound seed of recommended varieties should be treated with an effective fungicide to kill the harmful fungi and bacteria on the seed and to protect seedlings against root rot fungi present in the soil. The seed should be sown only deep enough to provide adequate moisture for germination. A good crop rotation schedule must be followed. The seedbeds should be well prepared and the proper fertilizer applied. Only recommended resistant varieties should be grown. Good farming is the best method of reducing losses due to root rots of barley and other cereals.

Additional Reference

Mathre, D.E. Compendium of Barley Diseases. 1982. The American Phytopathological Society. St. Paul, Minn.